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April 1941

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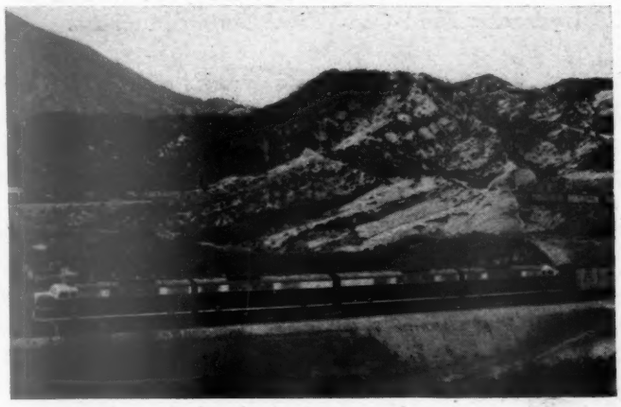

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Pacific type locomotive with

Poppet Valves Tested on P. R. R.

Franklin system of steam distribution installed on a class K4s locomotive demonstrates high drawbar capacity at high speeds in road tests and regular passenger-train service

A PENNSYLVANIA Railroad Class K4s Pacific type locomotive, No. 5399, was equipped with the Franklin Railway Supply Company's system of steam distribution with "O. C." poppet valves* during the summer of 1939. Following the completion of the installation at the plant of the Lima Locomotive Works, Inc., Lima, Ohio, the locomotive was placed in service on the Ft. Wayne division where it handled passenger trains between Crestline, Ohio, and Fort Wayne, Ind., and Crestline and Chicago, with periodical trips to Lima for inspection, for about one year. In that time it ran approximately 57,000 miles.

After the first month of road service the locomotive was subjected to a series of road tests with a dynamometer car duplicating the 1000-ton passenger-train tests conducted by the Mechanical Division of the Association of American Railroads in October 1938.† Additional tests with the poppet-valve locomotive were also run with trains both lighter and heavier than the 1,000-ton train of the A. A. R. tests.

In the road tests the poppet-valve locomotive No. 5399 developed a maximum adjusted drawbar horsepower of 2,980 at 60 to 65 miles an hour, and the curve is almost flat from 50 to 75 miles an hour. Compared with the drawbar horsepower recorded in the A. A. R. tests, the poppet-valve locomotive showed increases of 24.2 per cent at 60 miles an hour, 32.7 per cent at 70 miles an hour, and 44 per cent at 80 miles an hour. The relatively high capacity of the locomotive at high speeds was also clearly evident from its performance in regular service. It repeatedly handled trains alone which are normally double-headed, frequently making better than scheduled running time. While most of the improvement in the performance of locomotive 5399 should be credited to the poppet valves, the increased steam-chest volume and free exhaust passages with which the engine is equipped, contributed to some extent.

* For a description of this system and its development see the *Railway Mechanical Engineer*, September, 1939, page 349.

† A summary of the results of these tests was published in the *Railway Mechanical Engineer*, May, 1939, page 175.

Locomotive No. 5399 after the installation of the Franklin system of steam distribution with O. C. poppet valves

The valve-gear rocker shaft and crosshead connection—The end of the cam box can be seen through opening in cylinder jacket

In only two cases during the year of road service before the locomotive went to the test plant did it cause train delays chargeable to the steam distribution system. One was caused by a stuck intake valve and the other by a broken valve-gear-box drive pin. There was one other case of a valve sticking, but no train delay was caused. During the year five exhaust valves cracked and had to be replaced. In nearly every case this was done without holding the engine out of service. On one occasion repairs were also required to the cam-box oil pump and the locomotive was held out of service for repairs to one of the rocker shafts which transmit the drive from the crosshead to the valve-gear box.

To improve the quality of the valves they are now being machined from alloy-steel forgings instead of the commercial bar stock originally used. Changes in the valve-stem guides have also effected marked improvement in their resistance to wear, which is one of the causes of valve wear and of the cracking of the exhaust valves.

During the year the gear box and cam boxes were subjected to periodic inspection. No indication of wear was evident at any of these inspections. As mileage accumulated the cam surfaces and the link and link-block bearing surfaces assumed only a higher degree of polish, reflecting the effectiveness of the lubrication as well as the resistance of the materials in these parts to wear.

Indicator records of the pressure variations in the steam pipe and steam chest on one side of the locomotive suggested that restrictions to the flow of steam through the original Type A superheater were causing appreciable reductions in cylinder mean effective pressure at high speeds. To improve this condition the locomotive was taken out of service during the summer of 1940 to be fitted with a new superheater header, including a multiple throttle, and with single-pass Type ASW units. It was then subjected to an extensive series of plant tests at Altoona.

During the test-plant runs locomotive No. 5399 developed over 4,000 i. hp. on several occasions. At 75 miles an hour and about 30 per cent cut-off the cylinder output was 4,267 i. hp. and the drawbar horsepower, 3,862. This is one indicated horsepower for each 79.5 lb. of engine weight. The cylinders used 69,430 lb. of

Principal Dimensions and Weights of Pennsylvania K4s Locomotive No. 5399

Builder	Pennsylvania
Type of locomotive	4-6-2
Date built	1924
Rated tractive force, lb.	44,460
Weights in working order, lb.:	
On drivers	208,800
Total engine	330,800
Engine and tender two-thirds loaded	506,366
Driving wheels, diameter new, in.	80
Cylinders, number, diameter and stroke, in.	2—27 x 28
Steam pressure, lb. per sq. in.	205
Grate area, sq. ft.	70
Heating surface (total evaporative and superheater), sq. ft.	4,984
Number and diameter (in.) of poppet valves for each cylinder:	
Intake	4—6
Exhaust	4—7
Maximum valve lift (all valves), in.	1
Average clearance volume, per cent	8.41
Steam-chest volume (including steam pipe), per cent of cylinder volume:	
With poppet valves	73
Standard K4s	36.3

The reverse gear in the cab

steam per hour. At 100 miles an hour and about 30 per cent cut-off the locomotive developed 4,099 i. hp. and 3,547 db. hp.; the cylinders used 76,208 lb. of steam per hour.

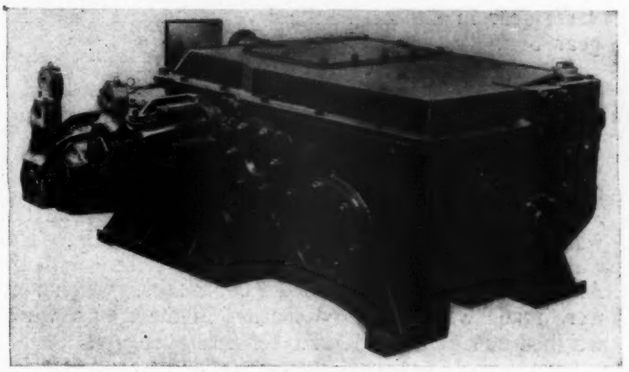
With an output of 70,000 lb. of steam per hour the pressure drop between the boiler and steam chest, through the new superheater was only 11 lb. per sq. in.

The Test Locomotive

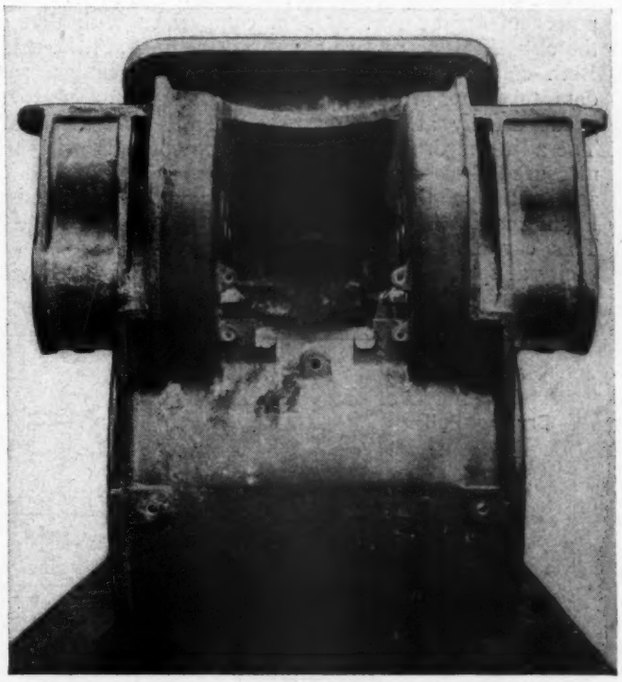
The principal characteristics of locomotive No. 5399, after the conversion are shown in the table. As installed on this locomotive, the Franklin system of steam distribution consists of four parts. These are the steam chests in which are fitted the poppet valves and which are cast integral with the cylinders, one at each end of each cylinder; the cam boxes, one mounted on each cylinder between the steam chests; the valve-gear box, mounted on the deck in front of the cylinders, and the power reverse gear.

The principal changes required in the locomotive were the replacement of the original cylinders with new castings incorporating the poppet-valve steam chests, and lengthening the front deck by adding a 9½-in. pilot beam. This was fabricated from steel plates, channels and angles by welding. The Walschaert valve gear was removed and a rocker shaft, supported from the engine frame, placed immediately back of each cylinder. The arm on the outer end of this shaft is driven from the crosshead. The inside arm drives the valve gear through a rod connection to the valve-gear box. Large openings through the exhaust-passage connections between the steam chests and the saddle are provided for these rods. The two oscillating cam shafts in each cam box are driven by rods which extend back from the oscillating-shaft arms of the valve-gear box, one of which furnishes the drive for the intake valves and the other for the exhaust valves. There are two 6-in. intake valves and two 7-in. exhaust valves in each of the four steam chests.

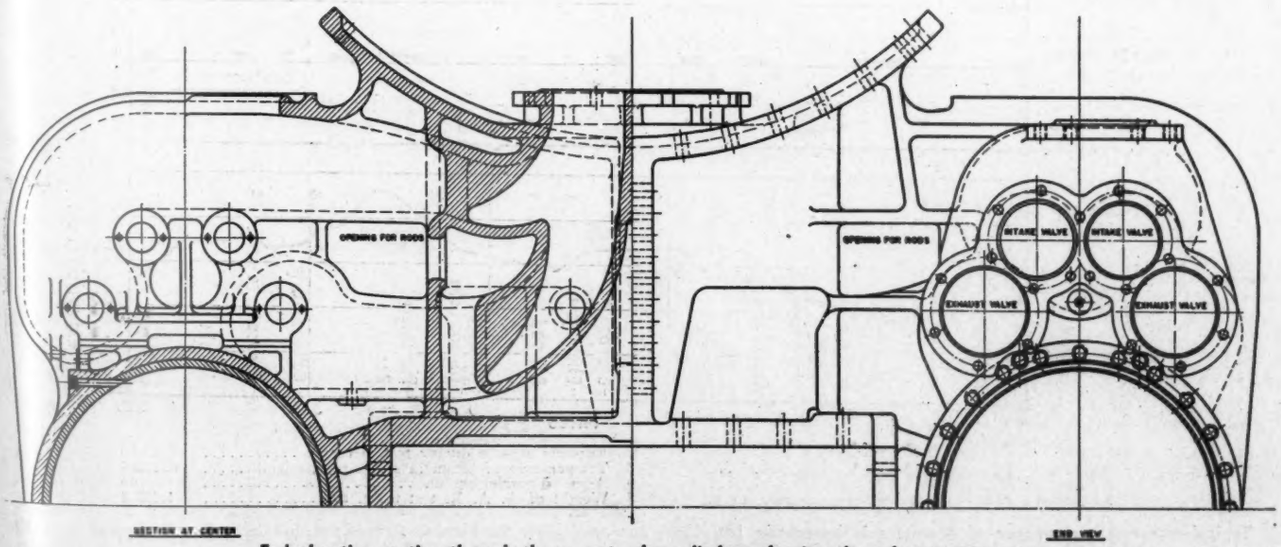
The valve motion is reversed by a train of gears in the valve-gear box driven by a shaft extending through the rear wall of the box. The reverse gear in the cab consists of an air-motor drive, controlled by a small lever, and a quadrant-type cut-off indicator. A shaft with suitable bevel-gear connections leads from the re-



The valve-gear box



Outside elevation of the poppet-valve cylinder for locomotive No. 5399



End elevation section through the poppet-valve cylinders, showing the exhaust passages

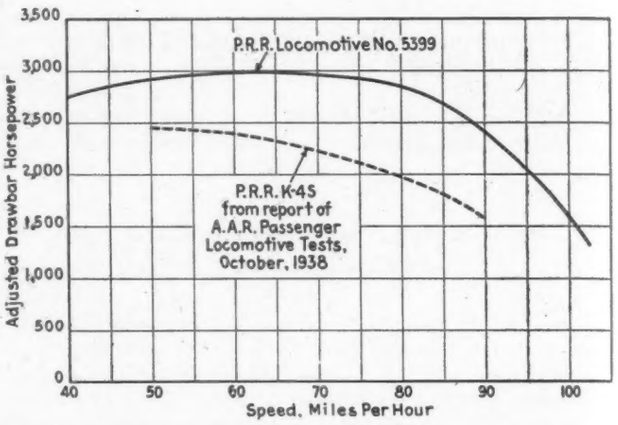
verse gear in the cab to the reverse shaft of the valve-gear box.

The Road Tests

The road tests were run on the Fort Wayne division between Fort Wayne Junction, Ind., and Valparaiso, a distance of 103 miles. The test train was made up of the same Pennsylvania dynamometer car used in the A. A. R. tests and Class P-70 coaches. A round trip was made with 15 of these coaches in the train. This train weighed 997.8 tons and compared closely with the A. A. R. train, which weighed 1,005.2 tons. Other runs were made with 9 and 18 coaches in the trains, which weighed 624 tons and 1,177.6 tons, respectively.

On the thousand-ton tests the speeds and the drawbar horsepower were, in general, higher than were developed in the A. A. R. tests. The comparison for the eastbound trip is shown in one of the charts.

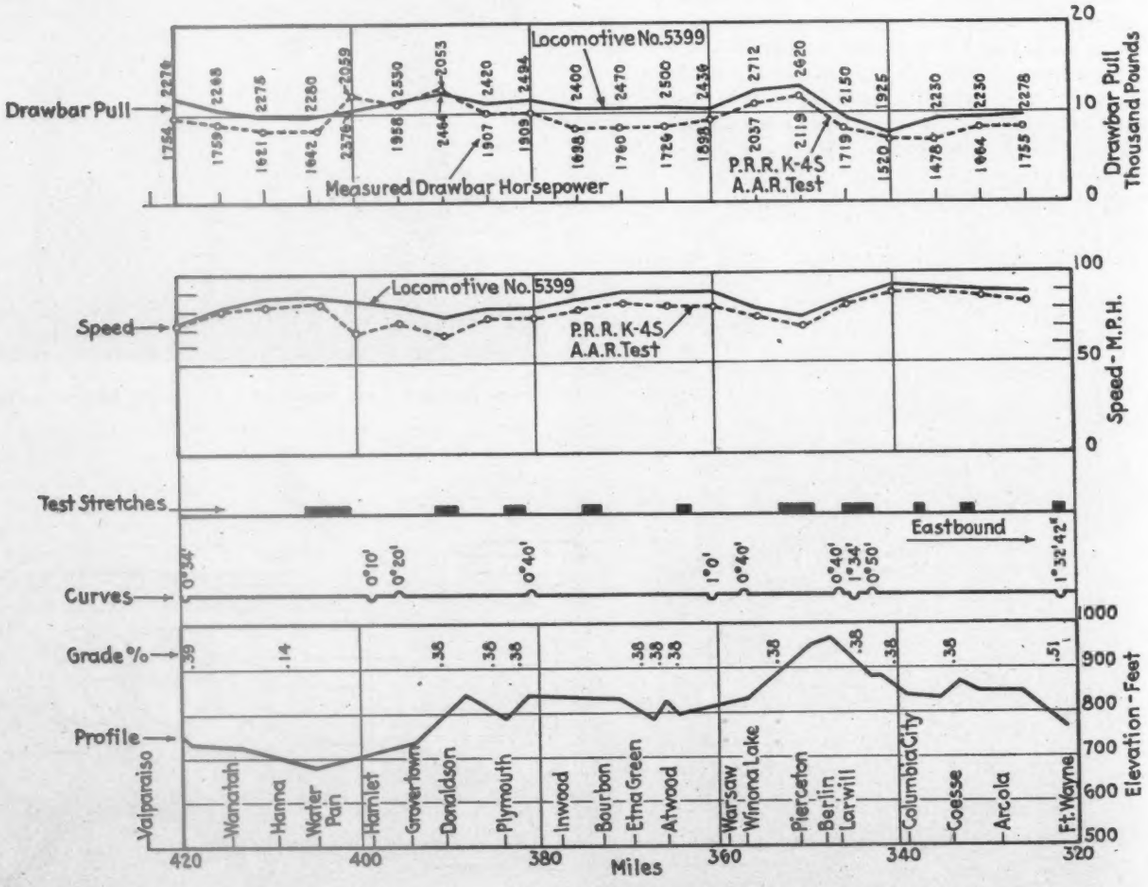
One of the graphs shows the adjusted drawbar horsepower of engine No. 5399 in comparison with that of the class K4s locomotive employed in the A. A. R. tests. Both curves are calculated in the same manner from data taken when the train was moving on a uniform grade usually at least 4,000 ft. longer than the train. The adjusted drawbar pull is obtained by correcting the measured drawbar pull for the effect of grade and of acceleration of the weight of the locomotive and tender. From this the adjusted drawbar horsepower is calculated. This curve indicates clearly the great increase in capacity at speeds of over 50 miles an hour, compared with



Adjusted drawbar horsepower developed in road tests by Pennsylvania Locomotive No. 5399

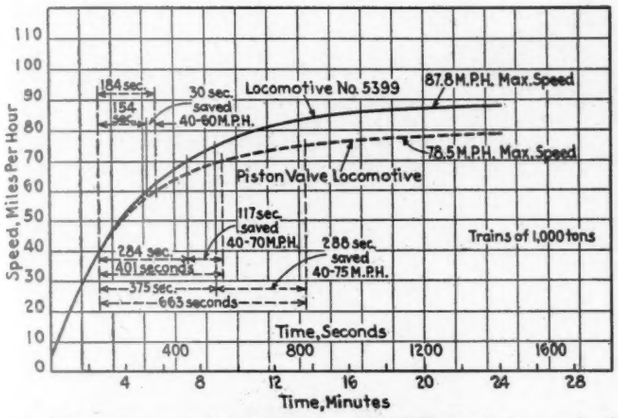
a locomotive of the same type equipped with piston valves and standard steam passages. The locomotive is capable of doing useful work at speeds above 100 miles an hour.

The high capacity of engine No. 5399 is also indicated by its acceleration performance. A comparison was made between the highest rate of acceleration of the 1,005.2-ton A. A. R. test train and that effected by engine No. 5399 with a 1,177.6-ton train. Both values were taken from the same piece of track. Corrected for level track,

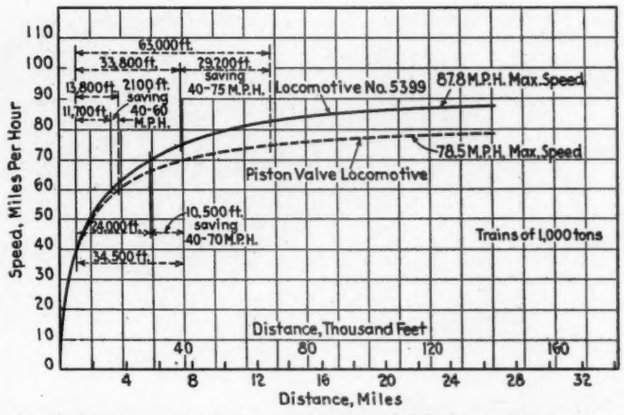


No. 5399:		Running cut-offs during test, per cent	28-50
Weight of train behind locomotive, tons	997.8	Temperature of steam in steam pipe, deg. F.	651,685
Average speed, m.p.h.	83.0	Area of nozzle, sq. in.	45
Maximum speed (from dynamometer chart), m.p.h.	94.7	Weight of A. A. R. test train, tons	1,005.2

Typical road-test performance of Pennsylvania locomotive No. 5399, equipped with the Franklin steam distribution system, compared with the Pennsylvania K4s Pacific Type locomotive used in the A. A. R. tests of 1938



Speed-time curves during acceleration of 1,000-ton trains on level track—Locomotive No. 5399 compared with a standard class K4s

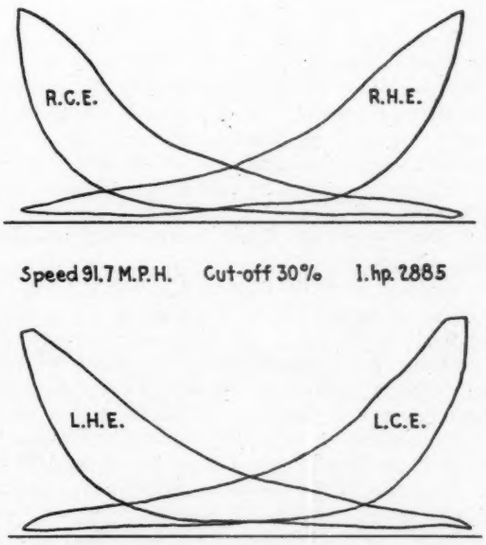


Speed-distance curves during acceleration of 1,000-ton trains on level track—Locomotive No. 5399 compared with a standard class K4s

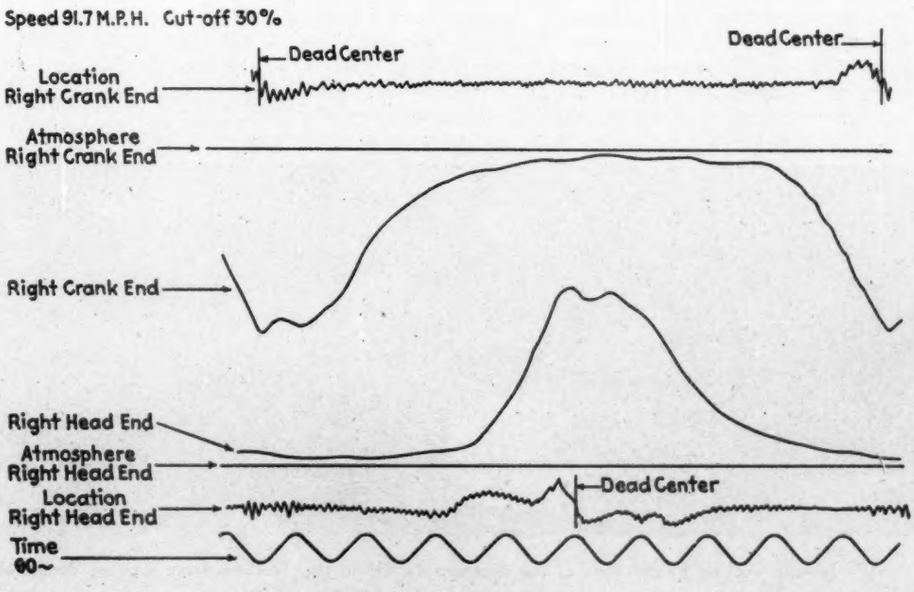
locomotive No. 5399 required only 255 sec. to accelerate the heavier train from 50 to 70 miles an hour, while the same change in velocity of the lighter train required 280 sec. Two of the graphs show speed-time and speed-distance curves, respectively, corrected for trains of 1,000 tons each. On this basis, the reductions effected by locomotive No. 5399 amount to 4 min. 48 sec. in the time and of 5.5 miles in the distance required to accelerate from 40 to 75 miles an hour.

Indicator cards were taken on all dynamometer tests from both ends of both cylinders at test sections of track. For the eastbound runs the test sections are indicated on the test-run chart. On a run handling a regular passenger train additional cards were taken from the right cylinder, and the pressures in the right steam chest and the right steam pipe at the superheater header outlet were recorded at the same time that the cards were being taken.

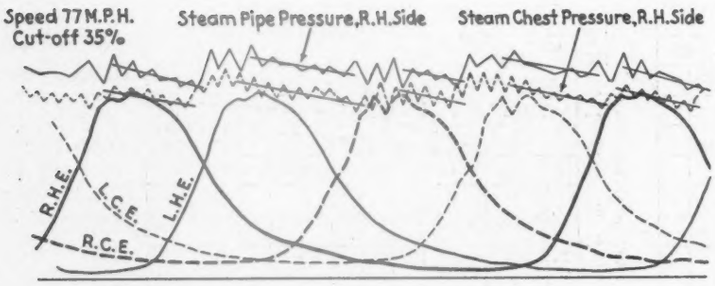
All of these data were taken with special indicators manufactured by the General Electric Company. The deflections of the diaphragm in this indicator are recorded photographically with an oscillograph. A typical record produced by the oscillograph is shown in one of the drawings. The indicator deflections are converted to pressure by the use of appropriate calibration factors.



A typical electric indicator card at high speed taken from Locomotive No. 5399 during the road tests



The original record from which the typical indicator card was developed



Marked fluctuations in steam-pipe and steam-chest pressure on one side of the locomotive are effected by the admission to the cylinders on both sides of the locomotive

Some of the records were also converted to conventional cards. A sample card taken at 91.7 miles an hour with a cut-off of 30 per cent is reproduced here. It is notable for its well-defined expansion curve, late release, flat exhaust line, and relatively short compression.

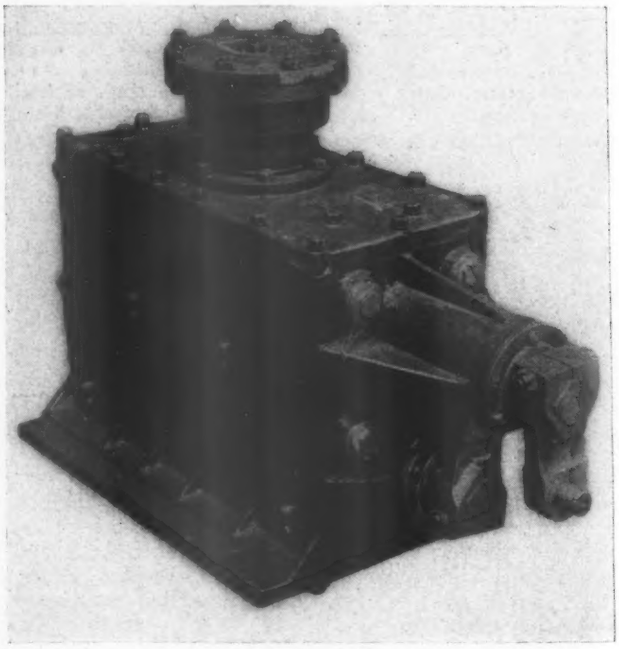
Reference has already been made to the high tractive capacity at high speeds demonstrated by engine No. 5399 during its regular service on the Fort Wayne division. The minimum cut-offs employed during each run varied all the way from 17½ per cent to 45 per cent. During the early part of the service period minimum cut-offs of 25 per cent were recorded for a considerable number of runs and shorter cut-offs for a few. Minimums of 30 and 35 per cent were reported most frequently.

There were many instances in which this locomotive demonstrated its capacity to make better than running time with trains of 13 cars on the fastest schedules of a very fast division. Two such instances of especial interest may be cited.

On November 5, 1939, engine No. 5399 pulled train No. 49 (The General) from Crestline to Chicago. The train consisted of 13 cars and weighed about 914 tons. It left Crestline nine minutes late, stopped at Fort Wayne for seven minutes instead of the scheduled five minutes, and passed Liverpool (the end of the Fort Wayne division) 11 min. ahead of time. For the 131.7 miles from Crestline to Fort Wayne the average speed was 67 miles an hour. For the 117.8 miles from Fort Wayne to Liverpool the average speed was 77.7 miles an hour. From Warsaw to Liverpool, 78.8 miles, the speed averaged 84.43 miles an hour. These speeds are all based on train-sheet time reports.

On November 15, 1939, engine No. 5399 pulled a special train from Chicago to Crestline against a heavy east wind. This train consisted of 13 cars and had an approximate weight of 1,150 tons. It made the 148 miles to Fort Wayne in 2 hr. 13 min., the exact running time of No. 28 (the Broadway Limited). Its only advantage was not making the regular Englewood stop. From Fort Wayne to Crestline the 131.7 miles were made in two hours, which is 5 min. less than the running time of No. 28. From Chicago to Fort Wayne the average speed was 66.8 miles an hour. From Fort Wayne to Crestline the average was 65.8 miles an hour. In both cases slow-downs for speed restrictions and to scoop water are included, and in the latter case there was also a stop for coal.

[An account of the test-plant tests will be printed in a later issue.—Editor.]



One of the cam boxes

* * *

Seventy-five car freight train of the Southern Pacific in the Truckee River Canyon, Sierra Nevada Mountains of California

C. & I. M. caboose after extensive reconstruction

C. & I. M. Rebuilt Caboose

Unusual facilities for crew comfort include four lower-berth sections, complete refrigerator, and two-burner oil stove for cooking, in addition to oil-burning heater

THE Chicago & Illinois Midland recently rebuilt and modernized a caboose which possesses a number of unique comfort and convenience facilities for trainmen, as well as including all of the safety features generally recognized by railroads as standard practice in caboose-car construction. The car was turned out of the company shops, Taylorville, Ill., in November, 1940, and has given exceptionally satisfactory service since that time.

In reconditioning the C. & I. M. caboose car, designated No. 65, no change was made in trucks, underframe or superstructure framing, as all these parts were found in first-class condition requiring only a few minor repairs. The exterior wood siding was entirely removed and replaced with ⅛-in. steel sheathing on the sides and ends of car. The interior lining and ceiling of the car body and the entire interior of the cupola was replaced with three-ply Douglas-fir plywood.

The sides, ends, roof, cupola and flooring were completely insulated with hair felt, paper backed. The entire interior, such as cupboards, seats, etc., was removed from the car and the interior rebuilt, using a different floor plan, as shown in the drawing.

The seats on the floor of the car are each supplied with a folding table and a wall-bracket oil lamp

The floor of this car above the wood consists of a red composition plastic ½ in. thick, laid over the wooden floor. A dry hopper, wash stand, water tank and water cooler, with outlet to interior of car has been built in one corner of the car in a space 3 ft. by 4 ft. 6 in., and in this compartment provisions were made for storing of markers when not in use. Across the car a side seat fully upholstered, 3 ft. 4½ in. long, is installed for the use of brakemen.

In the opposite end of the car, in one corner, are three trainmen's lockers, extending the full height of the car, approximately 3 ft. deep and 17 in. wide. Across the car from these lockers a built-in ice box occupies the full height of car. This is made in three sections, the bottom section for ice, the middle section for perishables, and the top section for the storage of canned goods and supplies used by train crews for the furnishing of their own meals while on the road or away from the home terminal. Immediately next to the ice box in a space 8 ft. 1⅛ in. by 2 ft. 2½ in. wide is a work table, a sink and water tank for the use of the crew in preparing their meal. Underneath, in this space, are built-in, enclosed cupboards for the storage of cooking utensils, the cooking being done on a flat top, oil burning stove, which has two burners.

Heating of the car is taken care of by an oil-burning

Looking from the cupola toward the end of the caboose—At the end of the car are lockers on the left and the refrigerator on the right

General Dimensions of Rebuilt C. & I. M. Caboose

	Ft.	In.
Length over body end posts	28	0
Length over coupler pulling face	36	8
Length over striking castings	34	2
Center to center of king pins	19	0
Length inside	27	5⅜
Width over side sills	9	0
Width inside lining	8	5⅜
Width at eaves	9	5½
Rail to center of drawbar	2	10½
Rail to bottom of side sill	3	5½
Bottom of sill to top of side plate	8	½
Rail to top of cupola roof	14	7⁹/₁₆
Rail to top of cupola signal lamp	15	11³/₁₆
Height inside at center in clear	7	3¹⁵/₁₆
Truck wheel base	5	6
Journals	4	¼ in. by 8
Track gage	4	8½

heater, burning fuel oil, which has given, during the extreme cold weather, very satisfactory service.

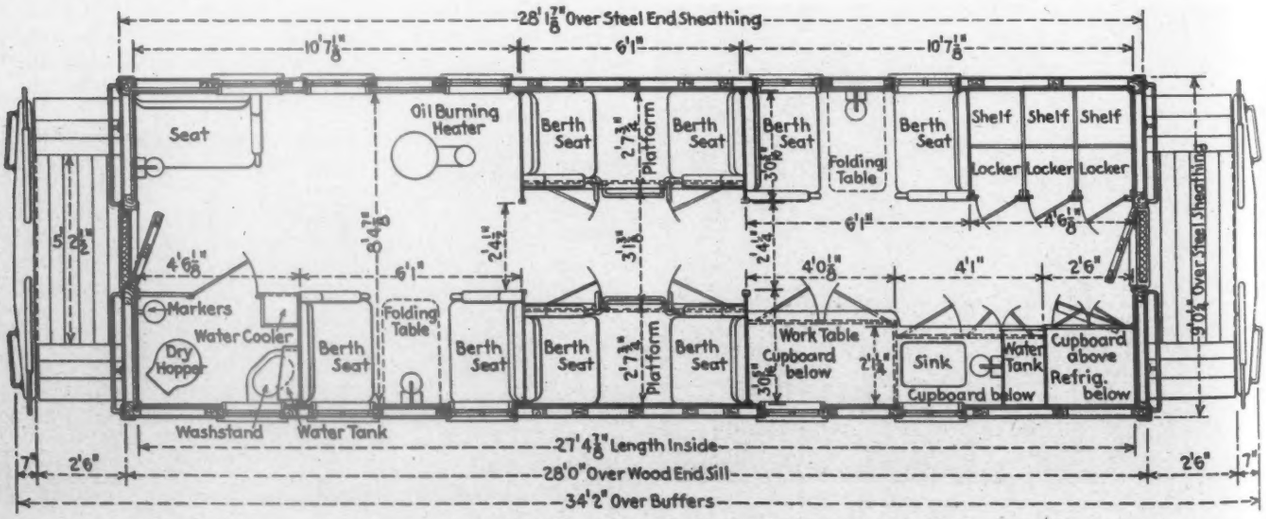
The cupola seats, two on each side, have been reduced in width to 2 ft. 7¾ in., and so arranged as to make up into two bunks similar in design to berths found in standard sleeping cars. The cupola was moved to the center of the car and it was necessary to lengthen the cupola approximately 2 in., in order to have a standard length of 6 ft. 1 in. available for making up a berth.

Seats are placed on the floor of the car, adjacent to the cupola, at diagonally opposite ends, and are so arranged that the two sections may be made up into bunks for the use of the train crew at night. In each of the sections on the floor of the car, a folding table is supplied for the conductor, so arranged that he may use either section and ride facing the direction in which the train is moving.

Kitchen facilities include a refrigerator, a sink with running water, cupboards, work table and oil stove

The entire space under the cupola platform on both sides of the car is taken up by enclosed cupboards. One

(*Continued on page 140*)



Arrangement of the facilities in the modernized C. & I. M. caboose

In Cajon Pass, Calif.

Santa Fe Installs High-Capacity

Diesel-Freight Locomotive

Built by the Electro-Motive Corporation, the locomotive has 5,400 engine horsepower, a starting tractive force of 220,000 lb., and a top speed of 80 m. p. h. — Dynamic brake designed to dissipate over 4,700 hp. through air-cooled grids

THE first Diesel-electric freight locomotive on the Atchison, Topeka & Santa Fe was installed in main-line service on a test run which began at Kansas City (Argentine), Kan., on February 8 and ended at Los Angeles, Calif., on February 15. The locomotive, No. 100, was designed and built by the Electro-Motive Corporation, General Motors subsidiary, La Grange, Ill. It was tested with a dynamometer car on its first eastbound trip as well as on the westbound trip. The locomotive has produced highly satisfactory results, and the Santa Fe now has three more of the same size and type on order from the same builder.

Besides being the first Diesel locomotive in regular main-line freight service and the first equipped with electric retarding brakes, the Santa Fe 5,400-hp. Diesel Locomotive, No. 100, is said to have greater tonnage-moving capacity than any steam locomotive ever placed on the rails. The table shows its starting tractive force of 220,000 lb. for example, substantially exceeds that developed by its nearest competitor, the Virginian 2-10-10-2 compound locomotive, built in 1918, even when the latter was operated for short intervals with single steam expansion. As compared with the Northern Pacific 2-8-8-4 single-expansion steam locomotive, built in 1929, the starting tractive force of the Diesel is 66,700 lb. greater, the total engine weight about 100 tons less and the length 68 ft. more.

In another table and on the drawing are given the principal dimensions and general arrangement of equipment in locomotive No. 100. The locomotive, with a rated top speed of 80 m. p. h., is designed so that it may be operated from control stations in the streamline nose of either end, thus eliminating the necessity of turning. The locomotive consists of four sections, hinged at three points to facilitate proper weight distribution, permit the locomotive to negotiate curves with ease, avoid high rail stresses and increase wheel life. This design also permits free movement of crew members through the locomotive with unusually easy access for all service or repair operations.

The design is further distinguished by a short truck rigid wheel base with all of its advantages. Each section has two four-wheel trucks and power is thus applied at 32 wheel points. The Edgewater heat-treated rolled-steel wheels are 40 in. in diameter. The trucks are designed to negotiate 23-deg. curves, or a 250-ft. radius, with 2¼ in. free lateral motion in the truck bolster and ⅜ in. in the journal boxes.

General Construction of the Locomotive Sections

The locomotive body framing, made of welded carbon-molybdenum steel, simulates bridge construction and is designed for high strength per unit of weight. Side paneling applied to the frame members is not included in stress calculations. At the cab end, collision framing above the platform consists of a combination of posts, plates and braces. Two large front posts are securely fastened to the platform and a deep anti-telescoping plate, the ends of which tie into heavy diagonal braces, are anchored in the side framing. The elevated cab floor

supports, front bulkhead and the rear partition members are all arranged to give added strength to the front end structure. Roof hatches are installed for easy installation and removal of engines, generators and other equipment.

The outside finish consists of panels of 3/8-in. plywood, completely covered with suitable gage Galvannealed steel with soldered edges to protect against moisture. This material is used because of its light weight and flat surface. Bolt holes not being permitted, these panels are clamped in position by the use of battens. Space between panels for batten bolts and to permit uneven expansion of materials is filled with a plastic asphalt putty. The streamline front end is covered with 12-gage steel which is welded to the framing and assists as a stress member.

The underframe construction is supplemented by a welded 1/2-in. floor plate which acts as a foundation for anti-skid runways. Body center plates are Grade-B steel castings, welded to the body-bolster assembly. Wear plates are applied to the bottom and outside surfaces.

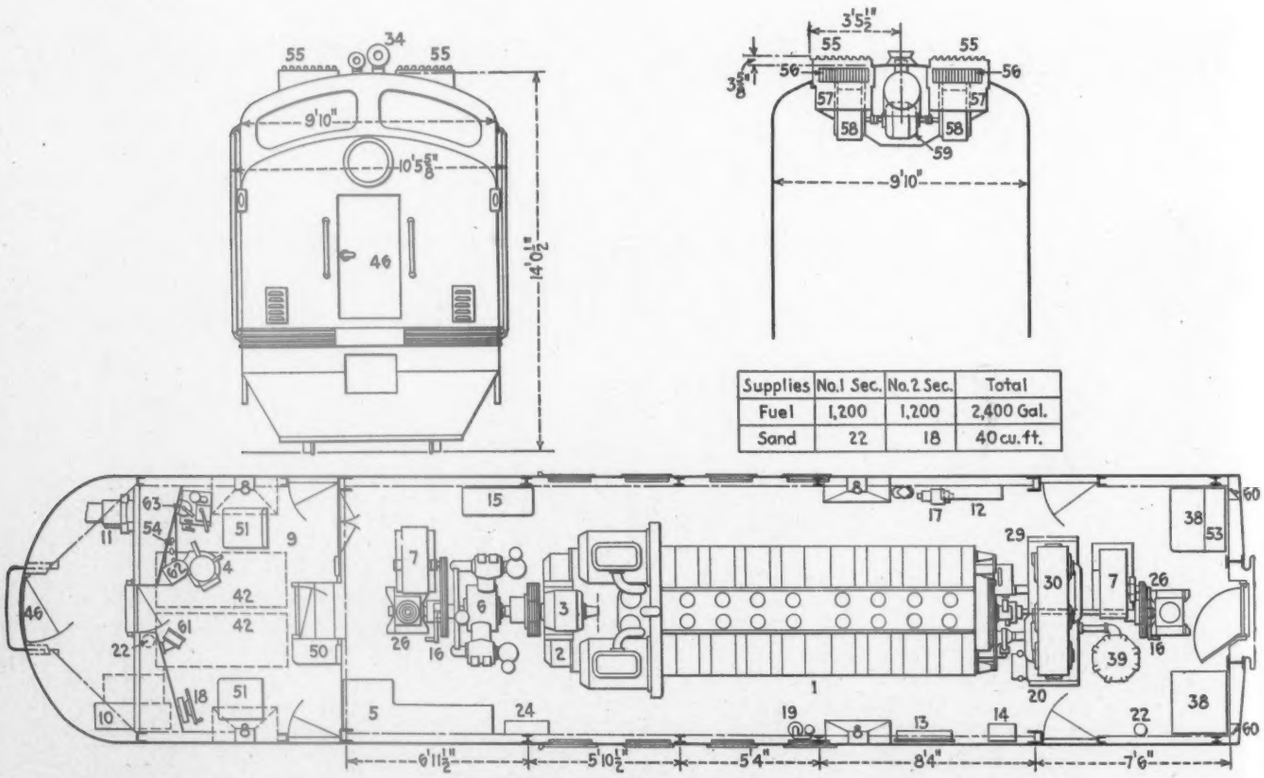
The locomotive control cab is located approximately over the front bolster. The cab floor is elevated above the locomotive platform to give maximum vision. The cab is accessible through a door on each side and from the engine compartment by means of a three-step stairway. The sloping V-shape front windows are equipped with automatic windshield wipers, defroster and sun visors. Drop sash side-windows are included. Swivel, adjustable, upholstered seats, with back and arm rests are installed at both the engineman's and the fireman's position. Cabs are soundproofed against both engine-room and track noises. Safety plate glass is used in all windows and doors. The front windshield glass is 9/16 in. thick and all other 1/4 in.

Front and rear couplers are A. A. R. Type-E with

Santa Fe 5,400-Hp. Diesel Freight Locomotive Compared With Largest Steam Power Previously Built

	Length, ft.	Weight, lb.	Starting tractive force, lb.
5400-hp. Diesel locomotive (1940).....	193	923,600	220,000
N. P. 2-8-8-4 simple steam (1929).....	125	1,116,000	153,300*
Virginian 2-10-10-2 compound (1918).....	97	898,300	176,600†
Erie 2-8-8-8-2 triplex (1914)	90	853,000	160,000‡

* Includes 13,400 lb. for booster.
† Working simple; 147,200 lb., compound.
‡ Maximum tractive force, working compound.



1—Engines EMC Model 16-567—1,350 hp.
2—Main Generator EMC Model D-8
3—Auxiliary Generator
4—Controller
5—High-Voltage Cabinet
6—Air Compressor
7—Traction Motor Blower
8—Sand Boxes
9—Operator's Cab
10—Train-Control Equipment
11—Distributing Valve 8-A
12—Engine Control and Instrument Panel
13—Hostler's Control
14—Load Regulator
15—Low Voltage Cabinet
16—Fan Drive Clutch
17—Engine Fuel Pump
18—Hand Brake
19—Fuel Tank Vent with Flame Arrester
20—Lubricating Oil Tank
21—Air Valve
22—Fire Extinguisher
23—Ballast
24—Resistor Cabinet
25—Toilet
26—Fan Drive
27—Fans (26 in.)
28—Shutters
29—Engine Cooling Water Tank
30—Oil Cooler
31—Radiator
32—Exhaust Manifold
33—Air Intake-Cooling System
34—Horn
35—Sand Filler
36—Air Cleaner and Silencer
37—Fuel Filler
38—Batteries
39—Lub. Oil Filter
40—Fuel Tank—1,200 gal.
41—Generator Service Door
42—Main Air Reservoir
43—Air Intake—Engine Room
44—Air Filters
45—Fuel Tank Gauge
46—Door
47—Classification Light
48—Classification Flag Bracket
49—Blue Flag Bracket
50—Locker
51—Seat
52—Air-Brake Equipment
53—Distribution Cabinet
54—Instrument Panel
55—Louvers
56—Grids
57—Air Duct
58—Blower
59—Motor
60—Flag and Signal Lamp Bracket
61—Speedometer
62—Shift Indicator
63—Dynamic Brake Control

Floor plan, end elevation, and cross-section of the No. 1 Section of the Santa Fe 5,400-hp. Diesel-electric freight locomotive

special heavy shanks. The locomotive sections are permanently connected with metallic-hose connections. National Malleable Type M-380 rubber draft gears are used at the front and rear. The drawbar carrier is spring-supported. The coupler connection is designed for a swing of 17 deg. and has an 11-in. knuckle. The removable pilot is made of $\frac{3}{16}$-in. steel plate, substantially braced both laterally and longitudinally. A 7-in. rolled-section anticlimber is applied to the front end of the platform.

The Power Trucks

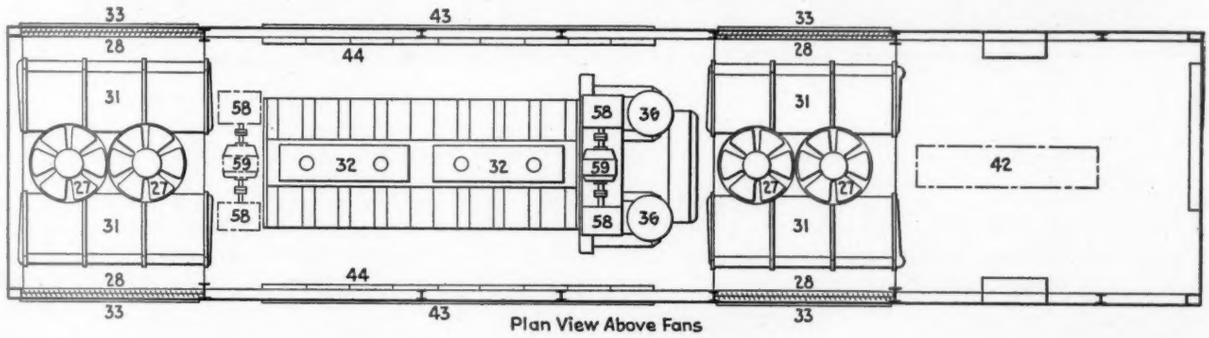
The four-wheel truck assemblies are interchangeable. Greater stability and improved riding qualities in negotiating curves are obtained by the same method of load suspension as on Electro-Motive six-wheel trucks for passenger locomotives. The alloy cast steel truck frames, made by the Locomotive Finished Materials Company, are supported on each of the four journal boxes by twin-group coil springs. The swing bolster is supported at each end by quadruple full-elliptic springs. These springs rest on each end of the spring plank which in turn is carried by spring hangers pivoted from the outside of the truck frame. Each of the two traction motors in each truck is supported by the driving axle to which it is geared and a spring motor nose suspension on the truck transom. Truck assemblies are equipped with EMC design clasp brakes actuated by four brake cylinders per truck.

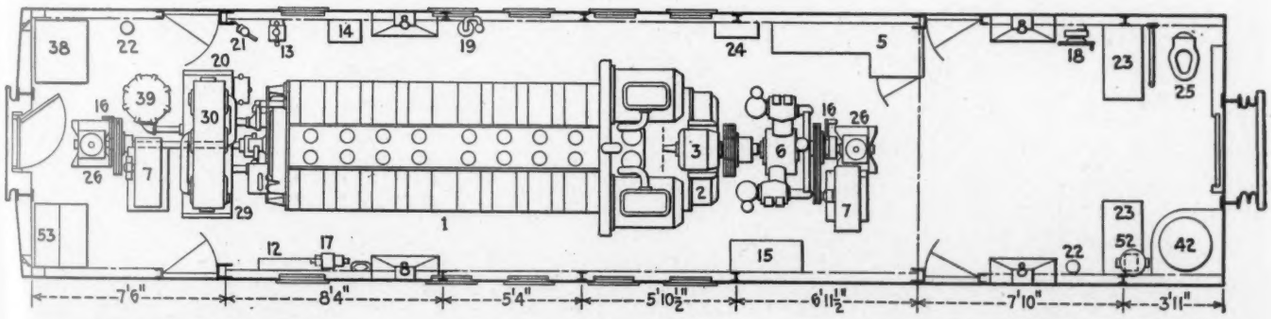
Four hydraulic shock absorbers are mounted between the truck frame and bolster to eliminate excessive lateral oscillation and to ease the body against the truck frames when entering or leaving curves.

The 6½-in. journals are equipped with Hyatt roller bearings of special EMC design, whereby the lateral thrust is removed from the journal bearing itself and taken through a cushioning arrangement directly on the

Principal Dimensions of Santa Fe 5,400-Hp. Diesel Locomotive

Overall length, ft.	193
Width over body posts, ft.-in.	9-10
Height above rail, ft.-in.	14-1½
Distance between truck centers, ft.-in.	27-3
Truck wheel base, ft.	9
Number of pairs of driving wheels	16
Wheel diameter, in.	40
Sand capacity, cu. ft.	80
Fuel capacity, gal.	4,800
Weight on drivers (fully loaded), lb.	923,600
Starting tractive force	220,000
Factor of adhesion	4.2





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30—Oil Cooler
31—Radiator
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44—Air Filters
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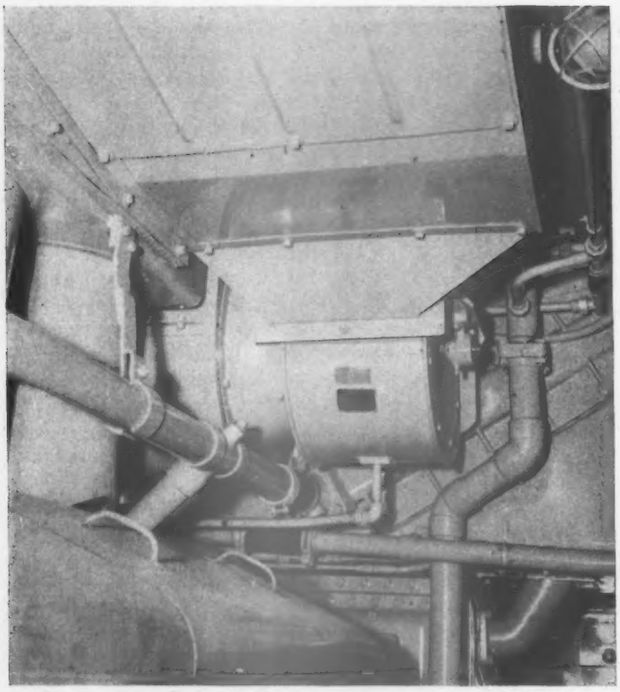
51—Seat
52—Air-Brake Equipment
53—Distribution Cabinet
54—Instrument Panel
55—Louvers
56—Grids
57—Air Duct
58—Blower
59—Motor
60—Flag and Signal Lamp Bracket
61—Speedometer
62—Shift Indicator
63—Dynamic Brake Control

Floor plan and plan view above the fans of the No. 2 section of the Santa Fe Diesel-electric freight locomotive



Motor-driven blower for cooling the grids in the dynamic brake circuit

box. Journal-box pedestal guides are equipped with spring-steel wear plates.

The truck center plate is designed with wear plates, dust guard and lubricating arrangement. Although the truck center plate is so large that there is no need for side bearings, the usual friction-type side bearings are included; also a special EMC-design truck and body interlock which serves to prevent the truck from sluing in case of derailment.

The Brakes

Westinghouse No. 8 EL brake equipment is installed, with KS-8-PB brake valve, safety control features and maximum-speed governor control. The brake pipe consists of copper tubing with extra-heavy brass fittings. Main reservoirs, only, are made of USS Cor-Ten steel with riveted seam and welded heads and have a capacity of 25,000 cu. in. each.

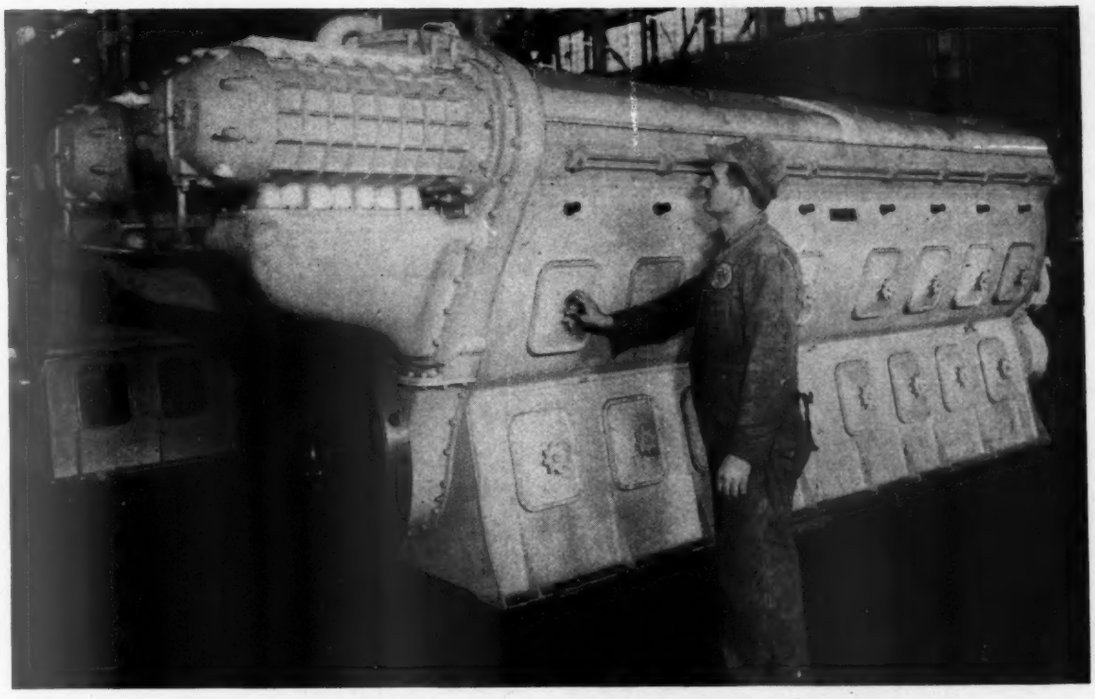
The brake-lever ratio on the truck is 5.66 to 1. Two 18-in. brake shoes per wheel give an average shoe pressure of 12,250 lb. in an emergency application. Based on an average loaded weight of 836,000 lb. for the locomotive, the braking ratio is 70 per cent with 50 lb. brake cylinder pressure, or 95 per cent with 68 lb. cylinder pressure.

During operation of the electric retarding brake, the power generated by reversed traction motors is fed back into air-cooled stainless-steel grids located in the roof where heat will be easily carried off. The brakes are designed to exert a retarding force of 80,000 lb. at 22 m. p. h., with a lesser step at which the retarding force is 54,000 lb. at 33 m. p. h. At the higher step the grids dissipate 4,690 hp. and at the lesser step, 4,753 hp. In either case the traction motors generate 540 amp. The brakes are designed to retard safely downgrade any load that the locomotive can haul up the same grade.

Power Plant Equipment

Motive power is derived from four 1,350-hp., 2-cycle, 16-cylinder General Motors Diesel engines, one in each locomotive section. Each engine is direct connected to an EMC 600-volt d. c. generator and a two-stage, three-cylinder Gardner-Denver air compressor. A supplemental 10-kw. auxiliary generator, adjustable between 74 and 78 volts, is mounted above and driven by vee

One of the four-wheel power trucks ready for application under the locomotive



General Motors 1,350-hp., 16-cylinder, 2-cycle Diesel engine—Seen from the blower end

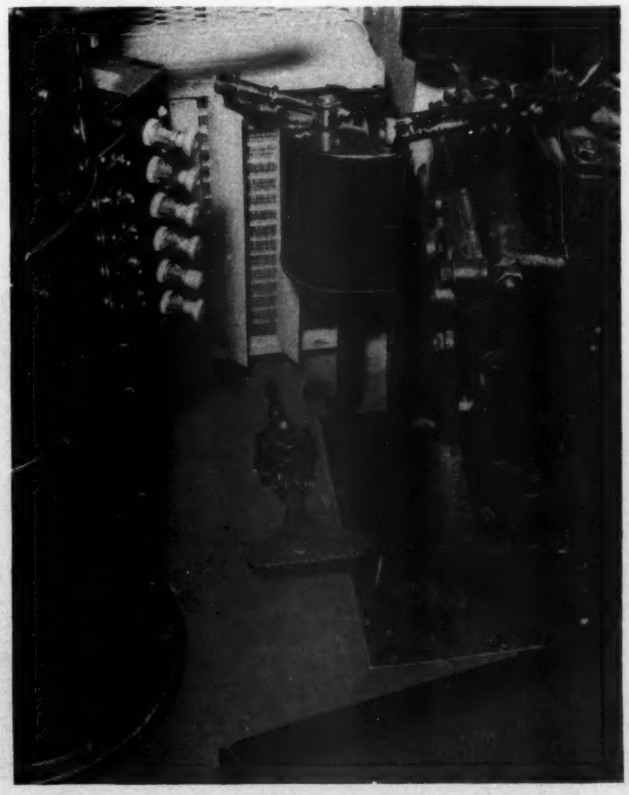
belts from each main generator. The generators are used as motors for engine starting. Each generator feeds four EMC Type D-7b d. c. roller-bearing motors, two in each truck assembly, directly geared to the driving axles. Motors are cooled by clean air delivered from blowers in the body immediately above the motors through ducts in the floor which connect with flexible rubber ducts held against the motor-housing air intake ports.

High-voltage control consists of manual transition forward and backward, with four motor connections, series-parallel, series-parallel-shunt, parallel and parallel-shunt. Switch equipment for transmission of single generator output to four traction motors is suitably arranged in ventilated cabinets. All high-voltage circuits are safeguarded by a ground protective relay. Two Exide 32-cell storage batteries are located, one in each first section.

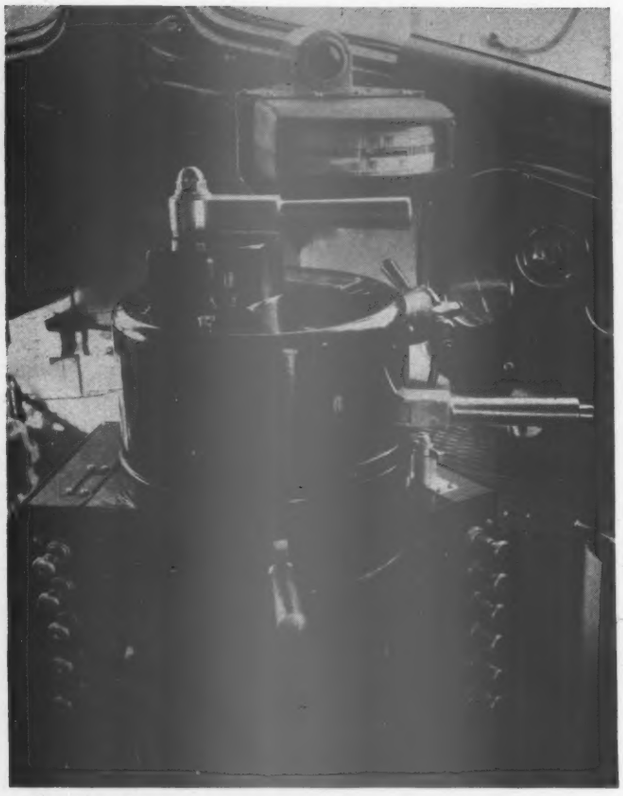
The cooling system for the engines consists of two 200-gal. per min. engine-driven water pumps and forced air circulation through Harrison fin-tube radiators located in the ceiling of the engine rooms. Each engine has a separate water supply tank with cooling-system capacity of 225 gal. Provision is made for steam jet preheating of cooling water from an external source after a layover period, if desired. Engine temperature control is accomplished by forced air circulation through seamless-tube type radiator assemblies. Four vertical 34-in. fans, driven from the engines through clutches, deliver approximately 80,000 cu. ft. per min. of air per engine. The engine air delivery is completely controlled by means of the fan clutches and by the manually operated shutters mounted in the air intake ducts, located along the top of the locomotive sides.

A dual circulating lubricating-oil system is installed for each engine. This comprises a single-pressure pump for oil delivery from the supply tank to the engine lubricating system, a separate pressure pump for oil delivery from the supply tank to the piston cooling system and a scavenger pump for oil delivery from the engine sump through a four-element filter and three Harrison oil coolers into the supply tank. The capacity for the system is 190 gal. A motor-driven dual pump per engine drives the return-flow fuel system. The fuel tank capacity is 1,200 gal. per section, or 4,800 gal. total.

The electro-pneumatic trunk-line control system com-



Dynamic brake control and dead-man pedal on the cab floor



Diesel engine and motor controls—Traction-motor transition indicator

prises: (a) An engineman's control station containing throttle with engine-speed control mechanism, motor connection lever, reversing lever with actuating means for control of traction motor reversing position which lever when removed from the station voids all locomotive movements; (b) four-valve, eight-position, electro-pneumatic engine-governor operating mechanism, mounted on the engine; (c) power-plant control push-button box with fused switches for master control circuit, generator field, fuel pump and push button for engineman's helper call signal and defroster blower switch; (d) locomotive light switch box with five push button controls; (e) instrument panel, indirectly lighted, containing air-brake gages, speedometer and wheel-slip indicator; and (f) main-generator load meter to indicate proper motor connection.

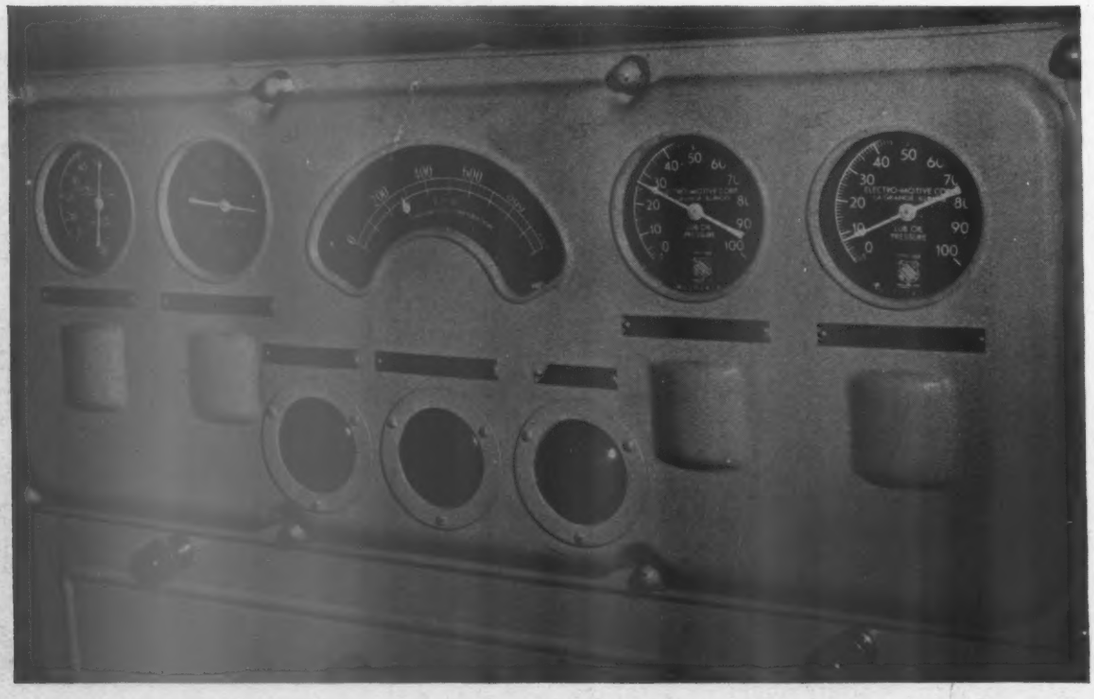
A local control station is installed in each engine room and includes start and stop buttons, isolation switch, master air valve to electro-pneumatic governor control, alarm system to show low oil condition, tachometer, lubricating-oil and fuel pressure gages, hot-engine indicator and fuel-pump contactor. The signal alarm system shows by gongs and colored lights low lubricating-oil pressure, hot engine water, wheel slip and hot journal.

Warning signals include soft and loud air-operated horns and one EMC 12-in. locomotive bell with internal ringer. Hot water, led from the engine-cooling system into two units with a fan-driven air circulating system is used to heat the cab control stations.

The Duco color scheme of the locomotive is Santa Fe dark blue with a wide yellow band separated from the blue by narrow vermilion stripes. A bronze Santa Fe medallion adorns each front end.

The Test Run

In addition to a varying number of freight cars, the west-bound test train included, at the head end, Diesel locomotive No. 100, a dynamometer car and five business cars to accommodate officers of the railroad and the locomotive builder, as well as about 20 observers who were invited to witness the tests. The train left Argentine, February 5 and arrived at Los Angeles February 8, in a total elapsed time of slightly over 72½ hr., as shown in the table which gives the general test results. No particular attempt was made for a speed record either by means



Pressure gages for fuel and lubricating oil, engine-speed indicator, and hot-engine, boiler-failure and low-water alarms

Top view of the Diesel freight locomotive taken during the test run

of unusually high operating speeds or reduced delays on the road and at terminals. As a matter of fact, the running time for this trip of 1,761.8 miles was 54 hr. 35½ min., which gives an average running speed of 32.3 m. p. h.

The locomotive demonstrated ample reserve capacity to handle heavier trains than the one used in the test and at substantially higher speeds. For example, the test train, with a maximum of 68 cars and 3,150 tons, was handled successfully over ascending grades up to 1.6 per cent westbound, without a helper, and at a speed generally of about 30 m. p. h. The maximum speed attained during the run was 68 m. p. h. between Amarillo, Tex., and Clovis, N. M., this portion of the road being predominantly a 0.6 per cent ascending grade.

On descending grades, the locomotive gave an excellent account of itself due to the dynamic brake. This feature was used at four places during the run for a total of 83 miles; namely, from Mountainair, N. M., to Belen, 17.5 miles; Supai, Ariz., to Ash Fork, 20.0 miles; Louise, Ariz., to Yucca, 23.0 miles; and Summit, Cal., to San Bernardino, 22.5 miles. Maximum grades on these four mountains ranged from 1.27 to 3 per cent. At a speed of 20 m. p. h., the retarding effect exerted behind the locomotive was 48,000 lb., and the horsepower 2,560. At 29 m. p. h., the corresponding figures were 35,200 lb., and the horsepower 2,730.

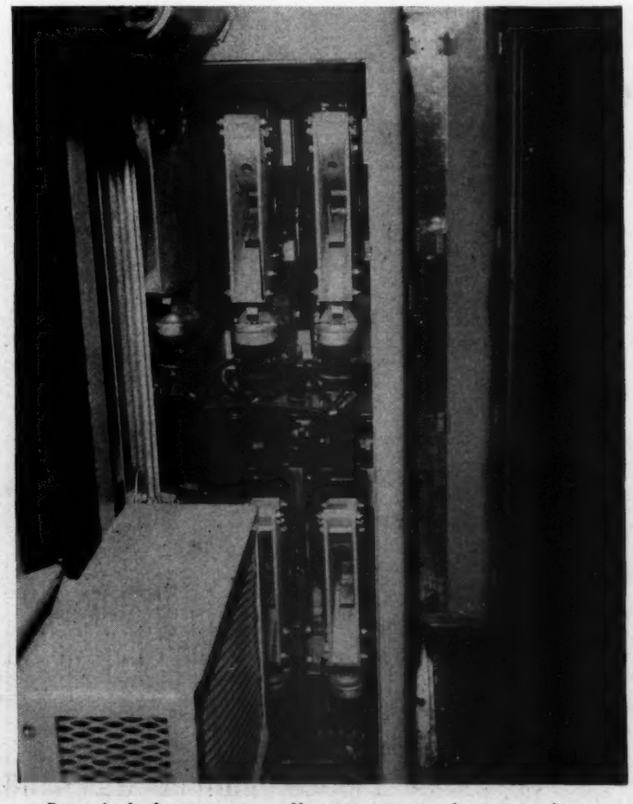
In negotiating the 3 per cent descending grade westward from Summit, the train length was limited to 50 cars in accordance with customary Santa Fe practice and the retaining valves were set up as an added safety measure. Where the dynamic retarding brake was used, it was necessary to set the train air brake only about one-fourth as much as usual. There was no evidence of excessive wheel heating throughout the run and when stops were made after descending heavy grades, the wheels never much exceeded bare hand temperature. The total energy absorbed by the dynamic brake during its use on this run is estimated at 19,700 million foot pounds, or approximately 10 per cent of the entire energy that was used to move the train throughout the test run.

The next most significant thing about this Diesel freight locomotive test run was the fact that a total of seven steam locomotives would ordinarily have been required to take the same train from Argentine to Los Angeles, with not less than 28 stops for water, on 12 of which fuel would also have been taken. The Diesel locomotive made the entire trip with only four stops for fuel and the addition of a little engine cooling water; namely, at Wellington, Kan., Clovis, N. M., Winslow, Ariz., and San Bernardino, Cal. The locomotive was serviced at Los Angeles and could have started the return trip, if necessary, with practically no delay.

Santa Fe 5,400-Hp. Diesel Freight Locomotive Performance on First Revenue Run from Argentine, Kan. to Los Angeles, Cal.

Total distance, miles	1,761.8
Running time, hrs.	54.59
Dead time on road, hrs.	6.15
Total time on road, hrs.	60.74
Dead time at terminals, hrs.	11.83
Total elapsed time, hrs.	72.57
Total number of stops	54
Minimum number of cars	49
Maximum number of cars	68
Minimum number of tons	2,262
Maximum number of tons	3,150
Thousands of gross ton-miles	5,171
Average running speed, m.p.h.	32.3
Average speed, total time on road, m.p.h.	29.0
Average speed, total elapsed time, m.p.h.	24.3
Minimum speed on grade, m.p.h.	15.0
Maximum speed on run, m.p.h.	68.0
Million ft. lb. at drawbar	198,858
Total fuel oil consumption, gal.	10,830
Unit fuel consumption, gallons:	
Per mile	6.15
Per thousand gross ton-miles	2.09
Per million ft. lb.	0.0542

Tonnage trains may be handled by this Diesel locomotive with fuel stops spaced 500 miles apart. The distance between the Santa Fe refueling stations, mentioned above, averaged 440 miles. Due to the installation of adequate fuel-pumping facilities and individual hose lines to the locomotive sections, the actual refueling time on the test run was shown to be 7 min., which



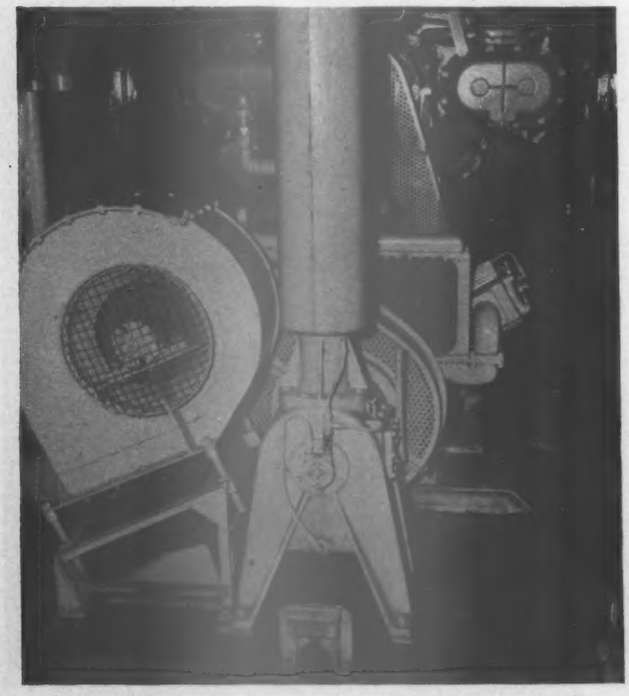
Dynamic brake contactors—Upper contactors for power, lower contactors for braking

The first 5,400-hp. Diesel-electric freight locomotive for the Santa Fe—Built by the Electro-Motive Corporation

may be compared with 35 min. formerly required when refueling from tank cars. On this particular run the locomotive consumed an average of 6.15 gal. of fuel per mile. In hauling the test train 1,761.8 miles, the unit fuel consumption of the locomotive was 2.09 gal. per 1,000 gross ton-miles and 0.0542 gal. per million ft. lb. of work done at the drawbar.

During the test run, and subsequently, this Diesel locomotive showed notable reliability of performance and high availability for service. After being thoroughly broken in, the locomotive made the test run without any special mechanical attention except the replacement of one cracked cylinder liner and cleaning two oil filters.

In both starting and rate of acceleration, the locomotive demonstrated highly desirable characteristics. With full engine power available from rest, the locomotive easily started tonnage trains and accelerated them to desired operating speeds in much less time than formerly required. Apparently the only necessary precaution, as indicated by the test run, is to increase the power output of the Diesel engines and the corresponding drawbar pull slowly enough so that unnecessary shocks and excessive stresses will not be introduced into the freight-car couplers and draft connections. There is no wheel slippage with this locomotive except possibly under unusually adverse wheel and rail conditions.



One of the electric-motor cooling fans installed in the engine room

C. & I. M. Rebuilt Caboose

(*Continued from page 132*)

side is used mainly for the storing of mattresses, bed clothes, etc., and the other side for the storage of oils, dope buckets and other train supplies. Kick plates, chromium plated, approximately 18 in. wide, are applied on each side underneath steps leading from the floor of car to the cupola platform and grab irons of 1-in. pipe are applied from the cupola roof to the cupola platform.

A flush-type stationary cabinet is also built into this space under the cupola for carrying the conductor's reports, stationery, etc. This is easily accessible to the conductor from his position in the section utilized for making out reports, etc.

Car light is supplied by the use of a lamp over each one of the lower berth sections, as well as a lamp over the work table used while the train crew is cooking and preparing meals. These lamps are of the improved coal-oil type with reflector. The 40-gal. water tank above the kitchen work table and sink is fully enclosed by fir plywood and supplies water for cooking, as well as for cooling hot boxes.

All doors on the car are finished by applying plywood over the standard door panels. The batten strips on the ceiling and walls, as well as all hardware in the car, are chromium plated. The car is equipped with a thermometer, drinking-cup container and fusee racks on both ends of car. All seat cushions and backs were covered with a No. 8 canvas duck in wide white and orange striping.

The entire interior of the car has a natural finish, the plywood being given two coats of white shellac and two coats of white varnish. The exterior of the car is finished with one coat of primer and two coats of caboose red Dulux enamel. C. & I. M. standard letters, numbers and monograms are applied. The car as rebuilt weighs 46,000 lb.

EDITORIALS

Little Corrosion In Passenger Cars

One of the important considerations in deciding whether to scrap or rebuild and convert railway car equipment is the amount of corrosion and deterioration which have taken place at critical points in the steel structures. In the case of steel passenger cars, at least, all evidence points to the fact that excessive weight and obsolescence limit the economic service life of the equipment far more than corrosion reduces its period of safe and effective service. One car owner, for example, reports that an examination of passenger-car structures 30 years old, which were thoroughly inspected during remodeling when the framing was exposed, showed an excellent condition of the steel frames and indicated strongly that corrosion is not a real factor in the life of passenger cars. Since the modern high-tensile steels now extensively used in passenger-car construction are reported to have at least four to six times the corrosion resistance of the steel used in older cars, the possibility of corrosion difficulties are still further reduced. It may be safely assumed, therefore, that passenger cars of the future will be written off and scrapped, as they have been in the past, primarily because their designs are obsolete and not on account of weakened structures due to corrosion.

Use Your Head

Unfortunately we humans, as a general rule, learn only from bitter experience. How frequently do we hear people say, "If we had only known, we would have acted differently." And yet, probably in most instances they had been warned, but went ahead regardless. One of the former Lehigh Valley apprentices, now working to qualify as a first-class machinist at the Charleston, S. C., Navy Yard, recently sent a letter to the supervisor of apprentices on that road at Sayre, Pa. "I am writing this letter," he said, "to plainly tell you that you were right and I was wrong when I was serving my apprenticeship. I want to tell you and Mr. Laux [J. P., the S. M. P.] and everyone else connected with the apprentices, that I wish I had been more careful with my lessons and listened to you all." In telling of his efforts to qualify for a better status he said that, "There isn't a job here a machinist gets that a blueprint isn't with it." In another part of his letter he said, "Although I am not trying to tell you your job, show this letter to some of your delinquent boys (if you have any) and tell them to snap out of it and profit by my mistakes."

Apprentice boys, however, are not the only ones who fail to profit from the experience of others and who find themselves regretting it later on. It is an error that most of us are likely to make, because we will not make the effort to face up to the realities and think our problems through to a logical conclusion. Rather, we are too inclined to stumble along indifferently, or in the attitude that somehow or other things will all work out satisfactorily in the end.

Significant Motive-Power Developments

Two articles in this issue deal with notable developments in the field of motive power. One is the description of the 5,400-hp. Diesel-electric freight locomotive recently placed in service on the Atchison, Topeka & Santa Fe. The other is the account of the road tests of the Pennsylvania Railroad's Pacific type locomotive equipped with the Franklin system of steam distribution with O. C. poppet valves.

The Diesel-electric locomotive is essentially a constant horsepower machine and its tractive-force curve approaches a hyperbola. If the voltage-current relationship were free from limitations, the tractive force of such a locomotive would, theoretically, approach infinity as the speed dropped toward zero. Practically, the maximum traction is limited by the weight on drivers and in the Santa Fe locomotive is rated at 200,000 lb. Such a locomotive possesses tremendous train-starting capacity and high accelerating capacity in the lower speed range—the range which is of relatively greater importance in freight-train operation than in passenger-train operation. Adding the dynamic brake, which is installed on the Santa Fe locomotive, this locomotive is particularly well adapted for heavy freight movements on lines with heavy grades—in the downhill as well as the uphill direction.

The poppet-valve installation is on a steam passenger locomotive and the road tests were in heavy, fast passenger service. Marked increases in capacity were shown at speeds above 50 miles an hour as compared

with a standard locomotive of the same class tested under similar road conditions. These increases amount to nearly one quarter at 60 miles an hour, almost one third at 70 miles an hour, and more than two fifths at 80 miles an hour. The results of these tests indicate that the poppet valve, through its more effective control of the admission and release of steam from the cylinders, provides a material extension in the limitations on the steam locomotive as to speed and capacity in passenger-train service. It will also undoubtedly influence the design of the steam locomotive built for heavy, high-speed freight service, the operating range of which will not fall far below that of the passenger locomotive, at least when measured in terms of revolutions per minute of the driving wheels.

Thirty years ago electrification appeared to be a serious contender for first place as the source of motive power for the railroads. Today, the Diesel-electric locomotive appears to be a more serious contender. It has many operating advantages but has yet to attain a clear title in the realm of economics. The outstanding advantage of the steam locomotive is its low unit first cost. Its future depends upon the continuance of the development of such improvements as that here referred to, without greatly increasing its unit first cost.

Defective Trucks Cause Many Hot Boxes

In an authoritative and highly constructive report, presented at the 1940 annual meeting of the Car Department Officers' Association, attention was called to a three-month survey of train detentions due to defective freight-car equipment on six representative roads, which showed that 1,183 train delays, or 52.4 per cent of a total of 2,255 delays, were caused by hot boxes. Judging from the figures quoted it seems reasonable to believe that concentrated efforts to improve this one undesirable feature of train operation will be more productive in reducing train delays than attention to any other single defect.

While proper lubricating materials and their application are obviously of the utmost importance in any campaign to minimize hot boxes, the committee report contained the following significant statement: "It is the consensus of your committee that improper truck maintenance is probably responsible for as many hot boxes as is the improper packing of boxes." Attention is thus directed to a sore spot in freight-car maintenance at many car repair points, and the committee suggests a remedy in attention to a number of details in maintaining freight-car trucks, the importance of which can hardly be over-emphasized.

Defective wheel conditions which may cause waste grabs and hot boxes come in for first consideration. Wheel-shop practice needs constant checking to make sure that journals are turned and rolled accurately and with the desired smoothness of finish. Obviously, this finish needs to be protected during the entire subsequent handling of the wheels until safely placed in the truck with brasses applied to protect the journals. Unless substantially more care is exercised than is sometimes the case in handling wheels, truck sides and bolsters in making truck assemblies, it is difficult to prevent journal collars and back fillets from becoming nicked, or the journals marred. Even a slight damage to the journal collar or back fillet is almost sure to cause a waste grab and hot box.

Similar careful attention to applying brasses which are in good condition, fit the journals and have also been protected against damage in handling, is also important. Wedges with straight backs are a definite invitation to bearing troubles and, if the wedge back condition is important, the bearing surface in the top of the side frame is equally so. A good many hot boxes are charged to the pinching of journal bearings on account of concentrated loads on the edges of the journal-bearing wedges, this condition being caused by hollow box roofs. Sometimes, on new boxes, there is a small fillet at the junction of the roof with the side wall instead of an undercut which is necessary to provide a smooth and straight bearing surface for the wedge.

Individual cases of carelessness and poor judgment probably mean little in their effect on the railroad problem as a whole, but when, as recently happened, qualified carmen and their foremen permit a freight-car truck to leave the shop with a non-standard replacement truck side which holds the plank 1½ in. higher above the rail than the other side frame, it is natural to wonder how often this may have happened. Conditions have been observed, where the spring plank itself was too short between the centers of the truck frames, causing them to bow in and resulting in a heavy pressure on the journal fillet. Similarly if the spring plank is too long and forces the truck frames to bow out, excessive fillet pressures and potential hot boxes are in prospect.

Proper attention to truck springs is essential and while broken springs are probably almost always replaced, more careful checking should be made to replace springs with less than the desired free height, which, if permitted to remain in service, present the probability that the journal will be subjected to over-solid blows and the brass distorted. To the extent that spring snubbers decrease the frequency of, or eliminate, over-solid blows, they also tend to prevent hot boxes. Still another mechanical condition, over which carmen have little control, but one undoubtedly chargeable with many hot boxes, is improper load distribution in cars, with resultant excessive loads on individual bearings and inevitable tendency to over-heat. Concentrated attention to even this limited list of truck defects will be sure to effect a further decided reduction in hot boxes.

Tool Engineering Assumes Important Role

The 1941 annual meeting and exhibition held by the American Society of Tool Engineers at Detroit, Mich., March 25 to 28, was something more than a big show and an important series of meetings; it was the tangible evidence of what can be done by a wide-awake organization with a purpose in building the society from a small group of 50 members in 1932 to almost 7,000 members in 1941; it was also a fine demonstration of the implements of production that have made America a great industrial nation. The exhibition and the technical sessions carried the work of production for national defense as a basic theme and showed how output is being and can be stepped up in work of such vital importance by the application of modern tools and tooling equipment.

Among the more than 250 companies which exhibited were many whose products are used by and are familiar to the railroad industry and it was noteworthy that the work of the society, its annual meeting and exhibition is attracting growing attention on the part of railroad men.

Tool engineering as a mechanical science and the work of the tool engineer has always been more or less associated with mass production such as that of the automotive industry. It is true that in such industries where there is a large volume of repetitive operations the possibilities for tool engineering are great. Hence, many men in railroad shops have ignored the real opportunities that are right at hand for improving the methods used in the machining and fabricating of locomotive and car parts because they have assumed that the relatively small volume of work of a given type or design must, of necessity, be done by the same methods that have prevailed for years. Such, however, is most certainly not the case, as many examples to be found in railroad shops today will prove.

Recently we were discussing the possibilities of better tooling methods with a mechanical officer who came up through the shop and is in intimate touch with shop work. He recalled a study that had been made in one of the shops on that road with the object of cutting down the cost and increasing production on a group of parts used in quantity on locomotives, which required operations on four types of machines in the shop. The tooling arrangements were carefully analyzed with the idea of stepping up the output of each of the four machines. Before any action was taken a visit was made to several industrial plants to see how similar work was done on a large-volume basis and as a result of these inspection trips it was found that the purchase of a single new machine with rather simple tooling equipment not only would make possible such an increase in output that the one shop could take care of the requirements for the entire road but the reduction in cost per part produced was sufficient to pay for the new machine in a surprisingly short period of time. The important thing was that the new machine was able to utilize tooling equipment and tool steels that it was impossible to use on any one of the four older machines that had previously been doing the work.

One need only spend a little time in the average railroad shop to realize that there are hundreds of ideas in every-day use in other industries that could be adapted to the operations performed in a railroad shop and save many thousands of dollars in the cost of locomotive or car maintenance.

Many of these ideas are not adopted because the average railroad mechanical officer thinks that a tool engineer, tool supervisor, shop engineer or a production engineer is just so much excess baggage on the payroll. Then, too, many roads have extremely capable men charged with the responsibility of improving methods in shop operation that are kept tied so close to their own roads and their own industry that they really do not have a chance to know what is going on in the world of industrial production.

No railroad shop man in a responsible production supervisory position could attend meetings and make contact with the production men from other industries such as were at Detroit for the A. S. T. E. 1941 Exhibition without bringing home enough new and usable ideas to pay for his time and expenses many times over.

New Books

PROCEEDINGS MASTER BOILER MAKERS' ASSOCIATION.—The price of the Proceedings of the 1940 Annual Meeting of the Master Boiler Makers' Association is $5 and not $3 as stated in the New Books column on page 108 of the March issue of the *Railway Mechanical Engineer*.

WELDING METALLURGY. *Volume I-II, 1940. By O. H. Henry, associate professor of metallurgical engineering, and G. E. Claussen, research assistant, Welding Research Committee, and adjunct professor of metallurgy, Polytechnic Institute of Brooklyn. Published by the American Welding Society, 33 West Thirty-ninth street, New York. 357 pages, illustrated. Bound in imitation black leather. Price, $1.50.*

Welding Metallurgy deals with the structure, properties and composition of the welded materials from which may be deduced the cycle of events which brought them about, or vice versa. It is a series of lectures prepared for presentation in a fundamental course of metallurgy and metallography at Polytechnic Institute of Brooklyn under the joint auspices of the Institute and the New York Section of the American Welding Society. It is intended to familiarize members of the welding industries, including fabricators and designers, with the composition and structure of the steel they use; to show how the steel is affected by the varied conditions of heat and stress in welding; to explain the mysteries of heat treatment, and to point out the way in which metallurgy can be used to control the welding process. The two volumes are bound together in one book.

Suggestions for Mechanical Associations

National Defense and Association Activities

The membership of the mechanical associations can only be built up if the railroad managements show that they are interested by allowing men to attend the meetings. In the past few years this has been impossible, due to the depression, but it would appear now that the necessity for improvements brought about by the defense program will stimulate the desire of the managements to obtain quicker methods of repairs, and lasting improvements. The work of these associations is very beneficial to both the members and the railways.

Freight Car Defects And Damage to Lading

I think the Car Department Officers should have a committee to deal with structural defects in equipment, as observed in service, in order that their findings could be placed before the Car Construction Committee, much as the territorial car foremen's associations now do with respect to interchange rules. I do not refer to design as such, but to the serviceability of the car as a protective freight vehicle. The Freight Claim Division, A. A. R., presented a long list of such defects to the Mechanical Division in 1937. This list by no means exhausts the so-called defects that reduce the opportunity to deliver the service we owe to the public. It ought not to be left to the claim men to make these discoveries available to those who can correct them or to stop them being produced in the first instance. The car man sees these deficiencies long before a claim voucher brings them to light. Ordinarily, freight damage producing defects in car structure do not come before the Mechanical Division's Committee on Car Construction from any organized source. The best such source would be the Car Department Officers' Association.

Hustle Committee Reports

I hope you will emphasize the necessity of getting the committee reports completed as quickly as possible. In order to get them out to the members of the associations early enough so that they can be read and digested before the meetings, they must be in the hands of the officers of the associations within the next few weeks and surely not later than June 15; the procedure of one of the associations—the Car Department Officers — requires a much earlier closure. I realize that mechanical department officers and supervisors are unusually busy at the present time, and yet, these mechanical meetings can mean so much to the railroads in increased efficiency and economy that no stone should be left unturned to make their programs as complete and effective as possible. With only two-day conventions, the meetings must be packed to the brim with meaty, constructive material. As little time as possible should be used for presenting the reports at the conventions; if possible, they should be presented by title only. All, or practically all of the short amount of time available should be used for the discussion of reports by men who have not only read them, but have studied them carefully and critically. The four associations that are scheduled to meet in Chicago next September have a real opportunity to make good in a big way, or just scrape by, or fail abjectly. The people now on trial are the committee chairmen and the committee members. Indifference, or lack of energy or initiative on their part at this time can be a "monkey wrench in the gears." Have they the guts to make good, or will they gum the works and place an insurmountable handicap in the way of success?

Preparation of Reports

It is my opinion that the best results are obtained in gathering material for convention topics by having the committee members first arrange a questionnaire to go to members of the association who are known through their activities to have the information desired; this first effort should be the responsibility of the chairman of the committee. When this has been accomplished, the chairman should instruct members of the committee to write personal letters to members who they know are familiar with the subject. A questionnaire has no real value unless it is followed up to show the individual that there is more interest in the topic than the preliminary questionnaire. It serves to arouse interest and to obtain more discussion on the floor of the convention. Replies when received by committee members should be forwarded to the chairman, who can either reject or ask for further information. While this will entail considerable correspondence, those who are interested will not object; it will bring out facts and will indicate a desire on the part of the association to render service to the railway managements.

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Comments from readers on suggestions made in our November, 1940, number for making more effective the efforts of the Mechanical Department Associations. See also January number, page 25; February, page 70, and March, page 109.

Get Your Young Men Interested

The rebuilding of mechanical department organizations after the depression has made it necessary to promote many men to supervisory positions, some of them comparatively young. I well recall that when I was at that stage of the game, many years ago, the boss sent me to one of the conventions. What an eye opener it proved to be. I did not know until long afterward that the "old man" had tipped off one of the officers, and to my amazement and distress, I had to get on my feet and express myself—but it was one of the best things that ever happened to me. What is everybody's business is nobody's business. Would it not be well for each association to appoint at once a live committee to get busy and get many of these newly promoted and younger men to attend the conventions? More than that, they could well see to it that they are encouraged to take part in the discussions. These men need friendship and acquaintanceship with older men. They need the information and inspiration they will receive from the meetings. On the other hand, we need their youth and virility to carry forward our work more vigorously.

Do Criticizing On Convention Floor

These conventions are held for the purpose of developing new ideas and concluding many open questions on previous suggestions that have been made and referred to committees for investigation and development. If all those interested could participate in the discussions on the floor and express their ideas at the convention, instead of criticizing action taken at the convention after it is over, I am sure it would bring about greater efficiency.

Prepare for the Discussion of Reports

Steps should be taken now, while the committees are still working on the preparation of their reports, to plan for the discussion on the floor of the conventions next September. Even though the reports are not yet completed, the committee members can talk with or write to their friends about what they are working on. Or they can assemble the names of men who are specially well equipped to discuss the report and plan to send them copies of it as soon as it is available. In brief, now is the time to do some real promotion work and to make plans for following it up. This will have some valuable by-products. It should assist in securing a larger attendance at the conventions and in increasing the membership of the associations.

THE READER'S PAGE

Standing Boiler Tests

To the Editor:

The ingenious, yet simple method of testing locomotive boilers developed by the engineers of the New York Central has been suggested as an inexpensive means of supplying the lack of basic data relating to the performance of large modern boilers to which C. A. Brandt directed attention in his paper presented at the 1939 annual meeting of the American Society of Mechanical Engineers.* It seems to be generally believed that the results recorded during these standing tests are comparable in every way with the boiler performance obtained during tests on the road or on a testing plant. One phase of the question, however, has so far remained entirely in the background.

The pressure of the steam passing through the exhaust nozzle in the New York Central standing tests is maintained at a constant level. Does such a condition ever exist in actual locomotive operation? Mr. Collins considers the performance of the locomotive boiler to be entirely independent of the engines. This would indicate, if only indirectly, his agreement with Dr. Goss' assertion that the draft-producing action of exhaust steam is independent of the intermittency of the exhaust.

There is extremely little available information dealing with the precise effect of the intermittent exhaust in locomotives upon the draft. It might be supposed that only negligible variations in draft occur at high speeds, especially with smokeboxes of comparatively large volume. That may or may not be true with the front end arrangements commonly used in America. But marked fluctuations in smokebox vacuum, far beyond expectations, were found during tests of modern 2-8-0 type locomotives in England, even when the exhaust beats were occurring at the rate of 18 per second.† This would correspond to a speed of 63½ miles per hour for a two-cylinder single-expansion locomotive with 79-in. wheels.

Just what effect would this fluctuating draft have on the efficiency of combustion? Those who believe that greater uniformity of draft improves the efficiency of combustion must conclude that Mr. Collins' tests are being conducted under ideal conditions, and will show higher efficiency than corresponding tests carried out on a testing plant or on the road. On the other hand, it has recently been stated as a result of long experience with two- and three-cylinder simple engines, that the slight lifting of the fire caused by the exhaust beats of a two-cylinder engine tends to promote better combustion than when a more even exhaust is used.‡ If one accepts this theory, then it follows logically that road or plant tests will give a better boiler performance than standing tests on the same boiler. The reader may take his choice. This is only one of the many problems of locomotive design which will continue to provide ground for argument, pending further research.

Finally, attention might be drawn to the high exhaust-steam pressures shown in Figs. 12, 13 and 14, on pages 99 and 100 of the *Railway Mechanical Engineer* for March, 1941. If, in order to make the boiler steam freely, the exhaust passages must be choked to produce an average back pressure up to 24 lb. per sq. in. during normal operation of the engines, the fluctuations in exhaust steam pressure caused by the intermittency of the exhaust beats may be largely damped out, resulting in a practically continuous blast through the exhaust nozzle. In such a case, it is quite conceivable that standing tests, plant tests and road tests will give the same results.

The high exhaust pressures shown in these figures demonstrate clearly that the efficiency of the American locomotive front-end can still be vastly improved. Why be content with a loss of from 700 to 1,000 hp. in order to create sufficient draft in the boiler of a high-speed locomotive working at full power? Certainly, no means of reducing the loss of power due to back pressure in the cylinders should be left untried. This problem is discussed at length in Lawford H. Fry's article on page 347 of the *Railway Mechanical Engineer* for September, 1939.

Wm. T. Hoecker.

* See the *Railway Mechanical Engineer* for February, 1940, page 47.

† Three Cylinder High Pressure Locomotive, by Herbert N. Gresley, Proceedings of the Institution of Mechanical Engineers, London, July 7, 1925, page 945.

‡ Locomotive Boiler Design, by E. S. Cox, Proceedings of the Institution of Locomotive Engineers, London, January 26, 1938.

Boiler Drop Plug Performance

To the Editor:

The 29th annual report of the director, Bureau of Locomotive Inspection, Interstate Commerce Commission, shows that during the fiscal year ended June 30, 1940, there were eight boiler explosions caused by low water on steam locomotives in the United States, an increase of two over the previous year. This report includes a "Summary of Boiler Explosions Resulting from Crownsheet Failures," and shows a complete record of boiler explosions for the past nine years.

In contrast to this, the Southern Pacific Company (Pacific Lines) has completed its ninth year without any accidents of this type, due to protection afforded by multiple applications of boiler drop plugs in firebox crownsheets.

The performance of this safety device during the calendar year 1940, as summarized below, again conclusively demonstrates its absolute reliability and effectiveness as a safeguard to life and property against hazards of boiler explosions due to low water:

Locomotives equipped with drop plugs	1,383
Total number of drop plugs in use	5,402
Cases of low water—engine crew responsible	6
Cases of low water—enginehouse forces responsible	9
Total number cases of low water in which drop plugs functioned	15
Total number cases low water in which drop plugs failed to function	0
Total number of drop plugs which functioned	43

It will be noted that in 1940, as in all previous years that boiler drop plugs have been in use, they have functioned in time to prevent serious damage to the boiler or firebox. Of the 15 cases of low water that occurred during 1940, in 13, or 86.7 per cent, the only work necessary was the renewal of the boiler drop plugs. An analysis of the work required on drop-plug-protected locomotive boilers shows that in 107 of the 138 cases of low water since 1932, representing 77.5 per cent, the only repair work necessary was the renewal of the plugs.

F. E. Russell,
Mechanical Engineer,
Southern Pacific.

Bending Brake Fabricates Car Details at Omaha Shops

A wide range of sheet-metal bending work is performed at the Union Pacific car shops, Omaha, Neb., on a Cincinnati bending brake.

The draft-sill reinforcing plates, shown on skids in one of the illustrations, are first punched on this machine and subsequently bent, ready for application to the car center sills. Many small dies are made in the local shop where production warrants the expense, and such parts as running-board brackets, number-card holders, plywood ceiling supports for freight cars, etc., are turned out quickly and at low unit cost. All pressed angles, tees and channels are formed in this machine, which bends ½-in. open-hearth steel 10 ft. long; ⅜-in. steel, 16 ft. long; ¾-in. steel, 8 ft. long; and 1-in. steel, 6 ft. long. One particularly ingenious die manufactured in the local shop and used in this brake makes it possible to manufacture end filler clips, in quantities, these clips being cut from band iron, punched and bent in a single operation at a rate of 30 per min. These clips are made in two sizes, ⅛ in. by 2 in., and $\frac{3}{16}$ in. by 3 in. The production of 30 per min. cannot be quite sustained throughout an 8-hr. shift, owing to the fact that the band iron is supplied in strips of a relatively limited length and there is a small amount of lost time between the forming of the last clip on one strip and placing a new strip in the machine. While even this small delay would probably not be permitted in an automotive production shop where certain parts are required to be made in the millions rather than thousands, it is not a factor of practical importance in this particular railway-shop operation. The average production of at least 1,200 end filler clips per hour is more than adequate to meet all railway shop requirements.

In the work of forming threshold plates, previously referred to, thirteen $11\frac{9}{16}$-in. holes and two 1-in. by 4-in. slots are punched in each 6-ft. section, this number of holes and slots being doubled when the threshold plates are punched in 12-ft. lengths.

Many pressings for passenger cars are made in this machine which was installed primarily for passenger-car work but has more than justified itself on account of the many unexpected uses developed in the manufacture of freight car parts. Among other special passenger shop jobs, large water-tank shrouds are formed in this machine. Where only a few are required, wooden dies, or forms are made, the upper and lower dies being bolted as usual to the machine base plate and ram by means of brackets. These water-tank shrouds are made of 16-gage Monel metal in sheets 7½ ft. wide by 16 ft. long. The curve on the bottom is a relatively large radius, with a short radius curve at either side of the car. In designing the dies, it is, of course, necessary to make all of these curves sharper than called for in the drawings so that when the metal springs back the sheet will have the correct shape and be ready for application in protecting the water tanks and other equipment under the passenger car bodies.

Bending a 6-ft. length of light-gage stock

Cor-Ten steel roof sheets are given the familiar Union Pacific turtle-back roof shape in this machine. They are made of ⅛-in. stock in 16-ft. lengths, four sheets being required per car. Materials of all different kinds are bent in this machine; the principal precaution necessary in the case of metal such as aluminum alloy, is to be sure that too sharp a bend is not attempted.

The machine used in performing these operations was built by the Cincinnati Shaper Company, Cincinnati, Ohio, and is capable of accommodating work up to 16 ft. long and exerting a maximum bending pressure of 210 tons. The slowest speed of the machine is 10

Draft-sill reinforcement plates which are punched and subsequently formed in the Cincinnati brake

strokes per min. and the fastest 30 strokes per min. One stroke at a time may, of course, be made by operation of the foot pedal, or the machine may be set for continuous operation. For use in punching operations numerous special dies are supplies by the manufacturer. The machine is said to have more than half paid for itself in the first year's operation.

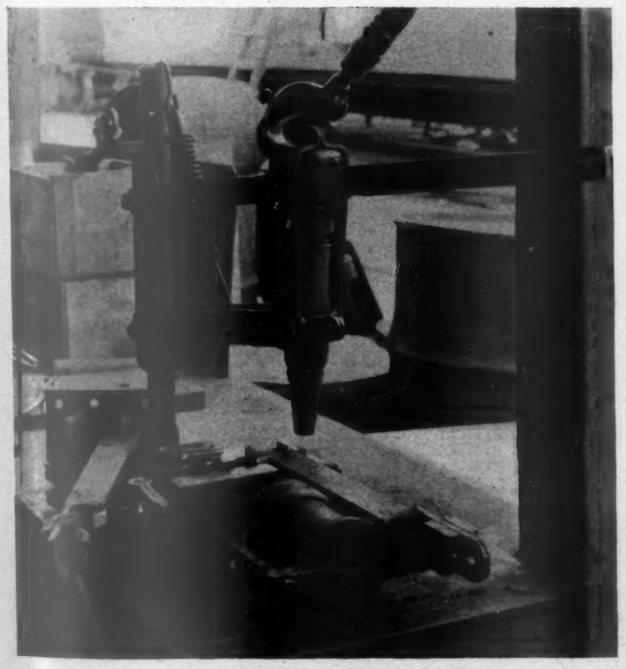
Riveting Hatchway Door Holders

The hatchway door holders commonly used to keep refrigerator-car hatchway doors either sealed shut, or in the open position for ventilation purposes, consist essentially of four parts, namely a steel base plate about ⅜ in. by 4 in. by 6 in., in the center of which are two riveted U-bolts, one being used for locking or sealing purposes and the other serving as a hinge support for the ⅜-in. by 2-in. holder bar, or ventilating arm as it is sometimes called.

The problem of assembling these hatchway door holder parts and riveting over the ends of the U-bolts after they are passed through the base plate is not an easy one to solve and the work involves considerable difficulty unless a suitable holding and riveting tool is available. A fixture developed for this particular job at one large western railway car shop is shown in the illustration. It consists essentially of a vertically operating air hammer, suspended above a pair of die-blocks which hold the U-bolts firmly and also support the ventilating arm and the base plate during the riveting operation. The fixed half of the die is firmly secured to the work bench and supports a 4-in. air cylinder which operates the moving half of the die. The air hammer is held in position by means of a pantograph which swings about a vertical 2-in. pipe section set in the work-table top. The upper arm of the pantograph is extended to form a handle or operating lever for positioning the air hammer over the U-bolts and applying pressure during the riveting operation. The weight of the air hammer is balanced by a spring so that it normally stays in the upper position.

The die consists of two steel blocks 2 in. thick by 4 in. wide by 9 in. long, recessed to hold two U-bolts at just the proper elevation for heading or riveting the ends after application of the base plate. Inasmuch as one of these U-bolts must be passed through the end of the holder bar, the upper surface of the die blocks is recessed at the right to a depth equivalent to the thickness of the holder bar. This enables the base plate to be fitted over the ends of the U-bolts and the holder bar and rest flush on the upper surface of the die blocks during the riveting operation for this particular U-bolt. After application of this U-bolt and the holder bar, the other locking or sealing U-bolt is applied, using the recess at the left in the die block.

The illustration shows a separate U-bolt resting on the upper surface of the movable die block and an assembled hatchway door holder at the left.



Convenient device used in riveting the U-bolts in refrigerator car hatchway door holders

Cleaning Large Stencils

The large stencils, now required to carry individual railroad slogans and other necessary information, including maps, frequently must cover almost half a car side and these stencils need be cleaned at least once, and sometimes twice a day in order to assure satisfactory results. The cleaning of such stencils constitutes something of a problem, which has been solved at the San Bernardino, Cal., car shops of the Atchison, Topeka & Santa Fe by means of the long stencil drip pan and other equipment shown in the illustration.

Drip pan used in cleaning large stencils at the Santa Fe car shop, San Bernardino, Cal.

The drip pan is made of 24-gage galvanized iron, 24 ft. long by 3 ft. wide by 6 ft. deep, stiffened with five small crossbars at the top which also serve to support the large stencil, held in an approximately vertical position by leaning against two posts, as indicated. The drip pan is equipped with a drain valve at the lower

left-hand corner adjacent to the barrel of distillate which is used for cleaning purposes.

In operation, a handle brush is used to apply distillate to the stencil which is brushed until all traces of paint are removed. The excess distillate drips into the pan and is drained off through the drain valve for re-use until too dirty to serve effectively in cleaning additional stencils. Approximately one hour is required for cleaning a stencil of the size shown in the illustration.

Magnaflux Testing Of Car Axles

In the Magnaflux testing of car axles, special equipment is used at one of the principal car shops of a western railroad. Unmounted axles are placed between centers in an old engine lathe which has had the headstock removed and the carriage replaced by a magnetizing coil mounted in a cylindrical box on rollers which moves along the V-ways of the machine. An extra long tail-center extension of 14 in. to 18 in. is required at one end, so that the magnetizing head, in one extreme position, will clear the end of the axle and permit inspection of the entire axle. The magnetizing head is, of course, connected by electric leads to the Magnaflux Type K3 testing machine which operates on 440-volt, 60-cycle, 60-amp. electric current.

Before attempting to test axles, they are cleaned with a distillate wash and wire brushed with a high-speed air motor to remove all dirt and rust or scale and thus facilitate a careful inspection for possible progressive cracks or surface defects. When necessary, the axles are also dusted with a light coat of unslacked lime to remove all traces of oil and moisture. Under favorable conditions sandblasting is the best method of cleaning, but sandblast equipment is not always available. When this method is used, a guard must be placed over the journal and dry collar to avoid damaging the journal.

Inverted push-car frame and wheels used in the Magnaflux testing of axles with mounted car wheels

The axle is sprinkled with Magnaflux powder for the entire length, a sheet-metal tray being used underneath to catch the excess powder which drops off. By moving the fully charged magnetizing head over the axle, any progressive crack or surface defect is then made evident, the broken lines of magnetic force causing the Magnaflux powder to be disturbed and give a visual indication of the extent of the crack. As a rule, most of the cracks are found just within the inside wheel fit. On large axles it is necessary to sprinkle and test the axle at three angular positions approximately 120 deg. apart. On smaller axles two sprinklings are adequate. The excess powder is brushed off the axle before each resprinkling and saved for re-use. From 32 to 38 axles are ordinarily tested on this machine in eight hours.

For testing axles with mounted car wheels, the inverted push car frame with close-set wheels is used to

Old lathe bed stripped and equipped with extended centers and a magnetizing head for Magnaflux testing of car and tender axles

support and revolve the car wheels during the testing operation. The 20-in. push-car wheels, with axles spaced 23 in. apart, are mounted on roller bearings and have the flanges cut off with the oxy-acetylene torch so that the car-wheel tread rests on the treads of the push-car wheels. In testing the axle with mounted car wheels by means of this device, five coils from the Magnaflux machine are placed over the journal or axle (between the mounted car wheels) and the powder sprinkled on so as to give an indication of any cracks or surface defects. The car wheels are then easily revolved and one or more additional sprinklings made as required to cover the entire circumference of the car axle. The axles of all mounted car wheels handled through the shop are thus given a careful Magnaflux test, the same cleaning method being used as that previously described.

Dip-Varnishing Wood Freight-Car Parts

The equipment shown in the illustration provides an efficient method of dip-varnishing any small freight-car parts which are made of wood and may require this kind of finish. As a matter of fact, the same method may be used in applying other paint finishes, but refrigerator-car parts such as floor-rack slats, bulkheads, side-door rails, hatch plugs, etc., are usually finished with

Equipment for dip-varnishing wood refrigerator-car parts of small size such as floor-rack slats, hatch plugs, etc.

one or more coats of clear, light varnish, as called for in the specifications.

Instead of attempting to varnish these parts by hand, which would be a relatively slow and laborious operation, the 3-ft. by 4-ft. by 24-ft. sheet-metal tank, shown in the right foreground of the illustration, is filled to a depth of 6 in. to 12 in. with varnish and the wood parts are simply thrown into this varnish tank. After being thoroughly immersed, the parts are piled on the drain board installed at one end of the tank, this board being pitched so as to drain all excess varnish drippings back into the tank.

When the parts are thoroughly dried they are easily moved to the hand push car, shown at the left of the illustration, for transportation to the storeroom or to the shop department where the parts are to be applied to cars.

Seat Covering of Box-Woven Plastic

A recent development in the field of plastic research is the production of colorful, box-woven Saran seat covers by the Heywood-Wakefield Company, Gardner, Mass. This development has been introduced to the transportation industry by the New York City Board of Transportation which placed in service a subway car equipped with seats covered with this material.

Among the advantages claimed for the seat covers is the ease with which they may be cleaned. Saran is non-porous. The dirt is confined to the surface and cleaning is a simple operation requiring only soap and water. Another advantage is the absence of splitting or cracking in this new material. A major annoyance with fibrous seating materials, due to cracking and splintering, is the damage done to passengers' apparel. Because of its toughness, smoothness and flexibility, this plastic eliminates any such damage. It is available in an extensive range of colors.

Saran is the name given to the fabricated forms of a group of new thermoplastic resins, technically known as vinylidene chloride, produced by the Dow Chemical Company, Midland, Mich. This particular family of plastics, being chrystalline in character, offer extreme flexibility combined with high tensile strength. Under tests conducted in the Dow laboratories this plastic has been flexed more than 250,000 times without breakage and experimental strands can be produced with a tensile strength as high as 100,000 lb. per sq. in. It is highly resistant to water, corrosive acids, alkalies, inorganic and most organic solvents. It will not burn.

This synthetic rattan is produced by an extrusion process into one continuous strand which speeds up the weaving and results in a finer finished material than is possible with the short lengths of natural materials. A contribution by Heywood-Wakefield technicians is the pre-forming of the seat corners after weaving.

Seats upholstered with Saran in a New York City subway car

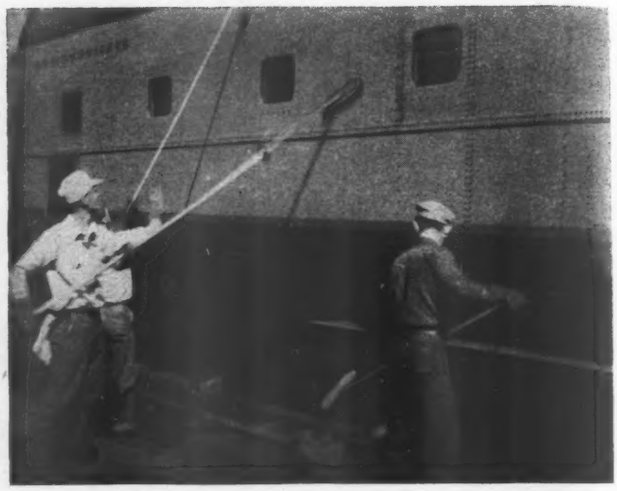
Oakite Develops Safe Passenger Equipment Cleaner

An important part in the maintenance of the attractive passenger cars now in service on the railroads is the care given to the colorful exterior finishes. During the last year, tests have been made by Oakite Products, Inc., New York, in perfecting a material for washing train equipment which is given comparatively frequent washings. It has resulted in the development of Oakite composition No. 70, a material possessing sufficient wetting out and cleaning properties to penetrate and remove the foreign matter encountered in most sections of the country. Besides these characteristics, the composition meets the demands of safety as it can be used at concentrations two or three times that which is ordinarily required without affecting the car finish.

In the actual use of this cleaning material, the best practice is to apply the solution by means of brushes and allow it to soak for five minutes to a half hour, depending upon the conditions encountered. The washing routine can be varied readily so that the longer soaking period does not interfere in any way with the progress of the work. It merely means that a larger area of the coach is covered before returning for the final rebrushing and rinse. The length of the soaking period with a water solution depends upon the ability of the solution to cling to the surface and the time that elapses before the solution dries. A long soaking period is not practical in many instances because many materials, even those that are free rinsing when in solution, are no longer free rinsing once they have dried out upon the surface to which they have been applied.

A dried out solution has no cleaning effect on the surface on which it rests, but if the material remains free rinsing, as does Oakite composition No. 70, a great deal of difficulty is prevented in those instances when drying occurs more rapidly than expected or when the washing procedure is interfered with for some reason or other. Even when applied to a warm engine jacket, for instance, where drying is extremely rapid, the deposit can be readily rinsed away, a result which would be impossible with most materials under similar circumstances.

Uniform washing results require the systematic coverage of the surfaces



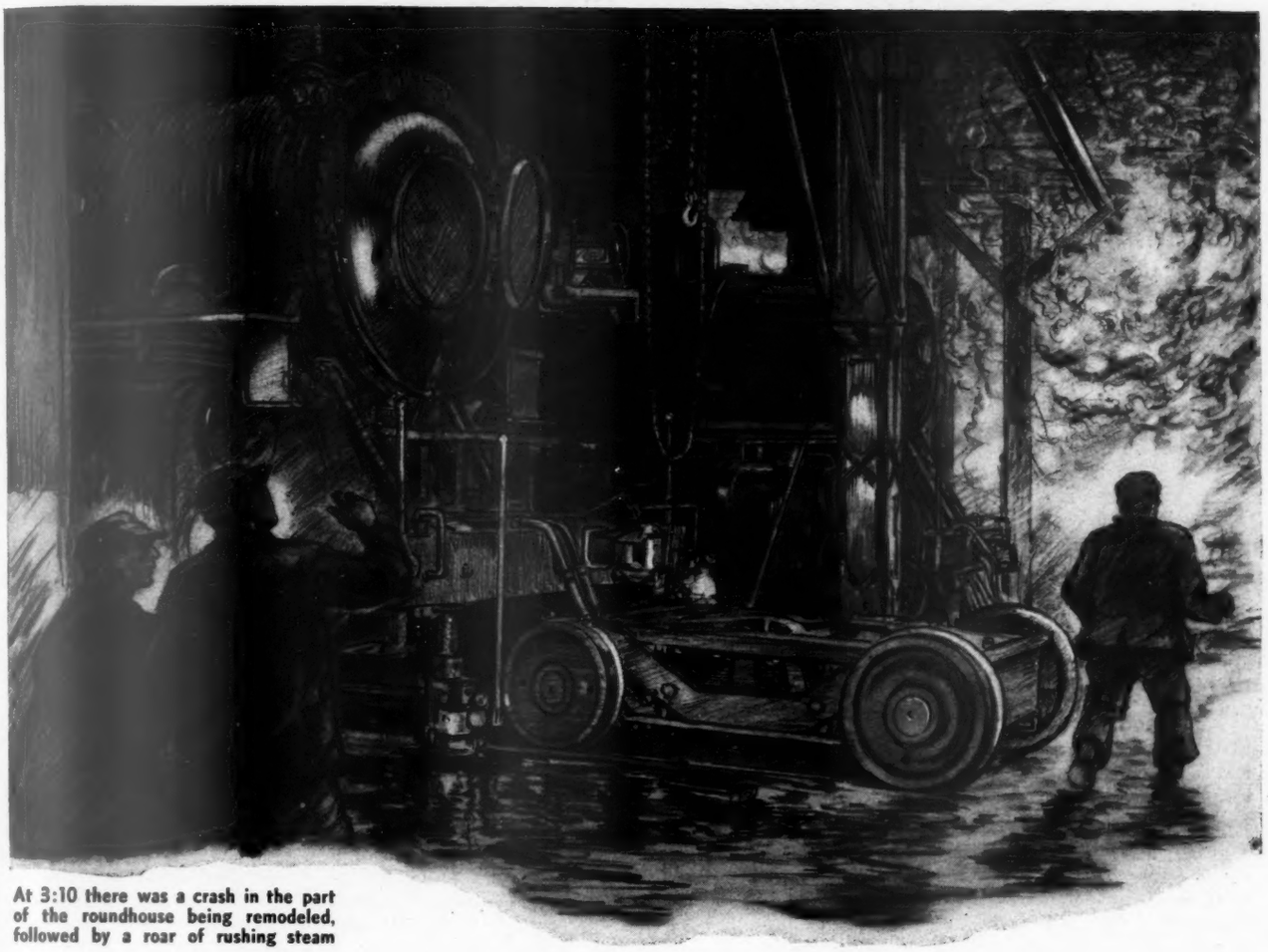
Washing a car with Oakite materials—The line of demarcation between washed and unwashed areas may be seen at the extreme right

In discussing the effect of cleaning solutions on synthetic finishes, it must be pointed out that the term "synthetic finish" is somewhat of a misnomer because often the resin alone is the only synthetic component of the material. The synthetic finishes, like the old-time finishes, may be classified as varnishes or lacquers. The lacquers contain nitro cellulose whereas the varnishes do not, but in either case, the material contains a relatively large amount of vegetable oil such as soy beans, tung oil or the dehydrated castor-oil products, etc., so that what is known as a "long-oil" type finish is obtained. The reason for the latter is that the finish must be durable, flexible and have the ability to withstand vibration.

The chief synthetic resins which are used are Glyptal (Alkyd) and the phenolic type, the former being used extensively. The presence of a relatively large amount of vegetable oil in the film and to a lesser extent the Glyptal resin tend to make these finishes more susceptible to alkali than if a "short-oil" material is used. In some cases the pigment may be affected by the type of cleaning compound but this occurs more generally with acid materials than with alkaline materials.

A neutral soap should give a pH of a little over nine but many soaps contain free alkali causing them to have a high pH and thus more liable to attack the finish. The pH of Oakite composition No. 70 is about the same as that of a neutral soap but because of certain ingredients, the tendency to attack finishes is less than that of a neutral soap.

With this explanation, the advantages of composition No. 70 are summarized as follows: Its pH is low and therefore it will not have a detrimental effect on many finishes that the more alkaline materials would have; the material is so compounded that even though the pH is low, good detergent action is obtained through emulsification and absorption; it tends to bring out the original color of the surface and to impart gloss to it; the material rinses very easily even though it is allowed to bake on the surface at a high summer temperature or if it is exposed to sub-freezing temperatures; it dissolves easily and completely with the exception of an insoluble ingredient which stays in suspension very well; the material is easy to apply and adheres very well to the surface, giving a relatively thick film which helps in the scrubbing, and the material will not harm the skin or clothes of the operators.



At 3:10 there was a crash in the part of the roundhouse being remodeled, followed by a roar of rushing steam

ALL IN SEASON

by
Walt Wyre

THE S. P. & W. roundhouse at Plainville was built like a mud-dauber's nest, by making additions as required to meet current demands. Mud-daubers, though haven't increased in size in the passing years, but locomotives have, and each succeeding addition to the Plainville roundhouse reflects that trend which accounts for the various lengths of stalls in the roundhouse.

The original roundhouse—four stalls and a lean-to for a machine shop—became too small for use nearly twenty years ago. The stalls were lengthened and a new machine shop built. These four stalls were made eight feet longer than the six adjoining stalls which were the first to be added to the original roundhouse. Three other sections of the roundhouse have stalls of varying lengths which spoils the old joke of looking for a corner in a roundhouse. Each different length of stalls makes an offset and at each offset there is a corner; not exactly corners, either, for corners are square and the portable crane has rounded all of the corners that project inward by knocking bricks off with tires, main rods, and sometimes the crane itself.

The six stalls of the second oldest section have been too short for much practical use ever since the S. P. & W. scrapped the 1700's they were using for freight service. Officials have been considering lengthening the stalls and raising the roof for several years. Last spring it was decided to do it. Perhaps a section of the roof falling in may have had something to do with speeding up the decision.

Jim Evans, the roundhouse foreman, was delighted when he learned the stalls were to be extended. Of course he did not expect work to begin immediately, but when Hallowe'en and both Thanksgiving days passed without any indication of the work starting, the foreman began to get uneasy. "Waiting until cold weather, I guess, like they always do," Evans commented.

The first week of December went by and Evans, busy with so many other things, had almost forgotten about the stalls to be lengthened, until one Monday morning a gang of men showed up at the roundhouse. "We are going to start tearing out the front half of the six stalls that are to be lengthened," the foreman of the gang told Evans, "and we will start on the roof."

"That means I'll have to get the engines out of those six stalls," Evans said.

"No," the gang foreman replied, "just out of the three stalls on the north side right now. We're going to start on that side first. It might be a good idea to have the other three stalls empty day after tomorrow."

The weather was nice and clear and warm for the time of year. The workmen made good time ripping the roofing boards from the roundhouse. Evans watched somewhat uneasily when the men started removing the heavy smokejacks and lowering them to the ground, but the job was handled carefully and without endangering any one. In three days the six stalls had no roof on the front half and Evans was without stall room for part of the engines. On the fourth day the men started taking down the heavy timbers that had supported the rafters of the roof and all of the roundhouse employees were cautioned to stay out of that section of the roundhouse.

THAT afternoon the fire-builder started a fire in the 5082 at 3:00. The engine was called for 4:15 and the fire-builder had little enough time to get the engine hot. At 3:10 there was a crash in the part of the roundhouse being remodeled, followed by the roar of rushing steam. At the same time the blower stopped on the 5082.

A boilermaker working in the hot fire-box of the 5090 rushed to the fire door and stuck his head out gasping for air. He managed to climb out and dropped down on the fireman's seat box. As soon as he got his breath the boilermaker started cussing his helper for letting someone turn off the blower. The helper denied the charge. He had been watching all the time and no one had turned the blower off.

Evans heard the roar of rushing steam and did a little rushing too to see what had happened. One of the heavy roofing timbers had fallen on the blower line which passed through the six stalls being lengthened and had broken the six-inch pipe at a joint. By the time Evans got there, someone had already closed the valve to the blower line.

It took forty-five minutes to rig up a temporary blower and there was thirty-five minutes delay on the 5082. Evans made some choice caustic remarks about workmen that dropped timbers on a pipe line which did no good except to relieve Evans' feelings somewhat.

After the roof and timbers were torn down, the gang of workmen started pulling down the brick wall.

"Say," Evans said to the foreman, "I thought you were going to build the new wall before tearing down the old one."

"That was the original plan," the foreman replied, "but my boss decided to tear down everything that comes out and get it out of the way before starting on the new work."

"What if it turns cold?" Evans asked. "You know we are already overdue a cold spell."

"Don't know; that's the way my boss said do it, and that's the way I'm doing it. Maybe the weather will stay nice until we get the wall built," the foreman said hopefully.

The weather at Plainville can change as rapidly as a woman's mind in a millinery store. At 4:30 in the afternoon, Jim Evans was running around in his shirt sleeves and wishing that he had waited awhile before putting on long-handled underwear. A low-lying blue haze in the northwest was the only indication of an impending change of weather. By 5:00 the sky was overcast with clouds and the thermometer had dropped almost to freezing.

"Looks like it might be cold enough to freeze the ears off a brass monkey before morning," John Harris, the clerk, remarked as he was preparing to call it a day and go home.

Then, just to show that it could be different, the weather changed again and it began to rain. When the sun slipped behind the horizon, the mercury dropped about two degrees and the drizzle began to freeze. The rain continued to fall and freeze wherever it hit. Ice began to accumulate on wires.

"If this keeps up, there'll be some wires breaking before morning," Evans told the night foreman when they changed shifts at 7:00.

"It does look bad," the night foreman agreed. "Guess I'd better get the engines out that are to run in case the electric power should go off."

All night long the drizzle continued to fall and freeze. Wires sagged under the weight of ice. Some of them broke, but the line to the roundhouse stood up.

When Evans got up next morning it was still too dark to see outside. He snapped a switch, but there was no light. "Must be burned out," he said to his wife, and tried another light. It wouldn't burn either. Evans dressed in the dark while his wife prepared breakfast by the light of a flashlight.

When he went outside, Evans could see why there were no lights. The wires from the pole to his house were broken. Trees in the yard were borne down to the ground with their burden of ice that still continued to accumulate.

On the way to the roundhouse, the roundhouse foreman had to drive slowly and with many detours to avoid tangled wires and fallen poles that blocked his way. Once he stopped barely in time to avoid a light pole that toppled down across the street.

"Say, this is the worst I ever saw," the night foreman said when Evans entered the roundhouse office.

"Yes, and getting worse. Have we still got power?" Evans asked.

The night foreman nodded, then said, "I talked to the manager of the power company about an hour ago. He said they would try to keep us going if possible. They have cut off the current everywhere except our line and the one in the business section.

When the roundhouse power line stood the strain all day, Evans thought perhaps it would not give way. It was sagging in long loops from bending poles, but unbroken when he went home that evening after a day that moved the gray of his temples nearer the bald place on top of his head. He knew it would be bad enough at best for the night foreman and tried to get all of the engines worked. Part of them had to be worked outside because there wasn't room in the roundhouse.

About ten o'clock that night a cold wind from the northwest drove the drizzle away and playfully pushed over most of the few electric lines that had stood the strain of ice. The night foreman had already collected torches, lanterns, caboose lamps, and everything else possible for illumination when the roundhouse lights went out at eleven o'clock. At the same time the hostler helper operating the turntable was turning the 5087 to put the engine in the house. The turntable stopped midway between tracks halfway from the empty stall in which the engine was to be run. The hostler went in search of the night foreman.

"Get a cable and pull the table around with an engine," the foreman told the hostler.

"Which engine must I use?" the hostler asked.

"Any of them outside that's hot," the foreman said in a tone that indicated that he didn't have room in his mind for any more trouble.

About two o'clock in the morning the norther hit and the mercury tried to imitate a "Stuka" bomber. The northwest wind whistled in through the gap where the wall had been torn down and through the rest of the roundhouse.

When Evans arrived on the job at 7:00, all of the engines that had come in since before midnight were

outside. The night foreman, hostler, and hostler helper were all busy trying to keep the engines from freezing up.

The night foreman, his eyes red, nose blue, and teeth chattering, came into the office. "I tried to call an extra hostler and helper," he said, "but the telephone wires are all down and I didn't have any one to send. There's nothing written in the dope book—didn't have time—just write one helluva night and sign my name. The 5091 will have to have a new pair of trailer wheels before she can run," the night foreman added.

"What time did the power go off?" Evans asked as he wriggled into a heavy sheepskin coat.

"About eleven o'clock. Guess it'll be off two or three days," the night man replied.

About nine o'clock a caterpillar tractor was sent to the roundhouse to pull the turntable around, but no means were available for operating other machines. As a result not a great deal of repairing could be done, but the men were kept busy watching engines and trying to keep warm.

Most of the work had to be done outside but it was almost as bad in the roundhouse. Heater blower fans wouldn't run and if they had the blustering north wind would have made sport of the gentle warm breeze. At every place where water dripped it froze and icicles hung from leaking pipes. An engine blown down and filled with hot water had frozen pipes before the fire-builder could get steam.

Engines that were in condition to run at all were serviced and turned. Ones that were not in condition to use were run in the house until by the middle of the afternoon serviceable engines were about all used up. One ray of sunshine in the mad melee was that the telephone wires being down prevented the dispatcher calling the roundhouse office. However, the "train delayer" kept a messenger hot-footing back and forth.

At 2:15 the messenger came in with a request from the dispatcher for an engine to run east with just a caboose.

"It's a wonder he doesn't want to doublehead it," the clerk said. "He has doubleheaded everything else."

"Might not be a bad idea at that," Evans commented. "It'll take two of the engines I've got left to get over the division, light or otherwise. I'll let you know what engine when you come back," he added to the messenger.

Evans wasn't joking when he said there weren't any extra engines. The best one left was the 5091 and the flange of the left trailer wheel was sharp enough to use for a razor. The engine had been run in the house and spotted over the drop-pit for the wheels to be changed when and if electric power was available.

Evans checked over the engines and there wasn't one available for the extra that could be run. He went into the machine shop where most of the machine men were grouped around the gas forge that the pipefitters use. "Let's go out to the drop-pit a minute," he said to two of the machinists. On the way to the drop-pit he picked up two more machinists and two helpers. "One of you bring an 18-inch pipe wrench," the foreman said to the machinists. "Now, what we've got to do," Evans explained when they reached the drop pit, "is to run this thing by hand. Let me see the pipe wrench."

The foreman took the wrench and tried turning the cross shaft that was geared to the motor. The shaft turned fairly easy, but the motion of the table was almost imperceptible. "It's going to be awfully slow, but it can be done," he said. "Get two more wrenches and try to keep it moving pretty steady. I'll send two helpers and one of you machinists can work on top. Tell the crane operator to bring in a pair of wheels."

When the foreman had left, the men grumbled a bit about the job, but they went at it with a will and were soon joking about the three jackass-power drop-pit. In a short time they had learned to coordinate the work so that the shaft was in motion continuously, but the movement of the drop-pit table was still discouragingly slow and it took almost three hours for four machinists and four helpers to change the trailer wheels which should be some kind of record. However, the engine was made ready to run, which was the main thing. Besides, the men would have been doing little else except trying to keep warm and cranking the drop-pit accomplished that.

Getting an engine turned and across the table was slow work with the tractor for power. It was almost impossible to spot the table for a track without considerable jiggling. There would have been some terminal delays if the trains had not all been running late. Telegraph, telephone, and signal wires were all down and trains were running on the time card. The superintendent and trainmaster helped some of the inferior class trains over the road carrying orders by automobile on the highway that parallels the railroad. Altogether it was a sweet mess, the kind that makes railroaders favor a younger retirement age.

When H. H. Carter, the master mechanic, came down that morning, he immediately got in touch with the power company to try to find out when service would be resumed. The answer he received was very indefinite and unsatisfactory. "Too much ice on wires and poles for men to do much," the superintendent of the power company said. "I've sent for all of the available linemen. Our local gang is working to get service to the hospital. The business section will come next, then the schools. It will probably be four or five days before we can get a line run to the roundhouse."

"What if we run our own line?" Carter asked.

"That'll be fine," the power company official said.

While Evans was wrestling with the problem at the roundhouse, the master mechanic, electrician, and a gang of men were knocking ice off wires, straightening up leaning poles and replacing broken ones. In most places wires between poles that were not broken had sagged so low that they could be reached with a short piece of pipe. The ice casing on poles was dislodged by jarring the pole with a heavy sledge. Carter, afraid that any one else would get hurt, did most of the sledging. It was surprising how agile a man of his age can be when two or three hundred pounds of ice start falling in his direction. He would hit a pole and jump back. One time his foot slipped. He fell face down on the frozen ground and skinned his nose. Just as he started to get up, a chunk of ice him him between the shoulders and down he went again. By night he was stiff and sore as one of Joe Louis' sparring partners after a hard workout.

The night foreman showed up a little early and Evans went home to supper but returned to the roundhouse in about an hour. It had been bad enough all day, but night and no lights made it worse. The wind was still whistling from the northwest. It was too cold to work outside and little better in the open roundhouse. Improvised salamanders made of metal barrels with the top cut out provided a lot of smoke and little heat. Men standing by them would freeze on one side and bake on the other while tears rolled down their cheeks from the smoke in their eyes. Evans stayed on the job until 10:00 then left it with the night foreman.

Next morning the weather was better but conditions weren't, especially the engines. The wind blew itself out sometime in the night and although the thermometer still stood around the nothing mark, it didn't seem so cold.

The tractor was still pulling the turntable, though, and every engine in the house was tied up for machine work. There were two serviceable engines outside, both called.

At 10:30 there wasn't a single serviceable engine at the terminal. The dispatcher had just sent word by a messenger that he wanted an engine at 12:30 and another at 1:15. The roundhouse clerk found Evans.

"What must I tell him?" the clerk asked.

"I'll go tell him," Evans said.

The foreman and clerk went to the office together where the messenger was waiting. "Tell the dispatcher that there ain't no more engines and won't be until we get electricity, unless an engine comes in that is in condition to run."

At that moment the electric light over the clerk's desk flashed on then went off. It came on again and stayed on.

"Wait a minute," Evans said as he dashed out of the office and headed to the machine shop. In the machine shop the foreman pushed the starting button on a lathe. The motor started. He rushed back to the office. "Tell the dispatcher to hold up a little on that first engine and we'll have it for him. It'll be the 5086."

At noon the contractor had a gang of men working on the roundhouse again cleaning out debris where the new wall would be. "The bad spell of weather delayed us a little on the job," the contractor said, "but guess we can always expect a little trouble."

"Yeah," Evans replied dryly. "If you had been around here for the past two days you wouldn't have been disappointed. I've been railroading quite a while, and there's one thing I want to see before I retire."

"What's that?" the contractor foreman asked.

"A roundhouse remodeled in the summer time."

Setting Tires In The Small Shop

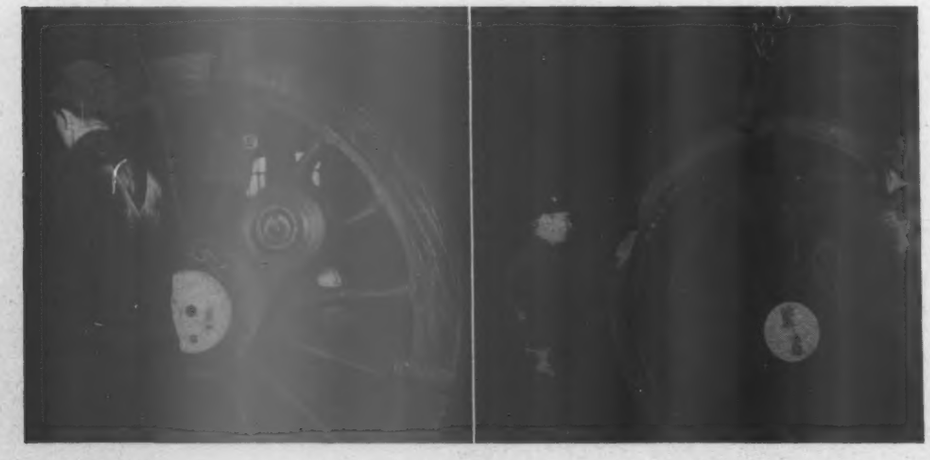
Applying tires in the small shop or the enginehouse is a difficult job that can be simplified by the use of the devices shown in the accompanying illustrations. One of the first requirements is a suitable stand on which to placed the mounted wheels. The welded pipe stand shown is made from 1½-in. pipe of such width as to permit clearance for an axle from which the driving boxes have not been removed. The radius of the curved top of the stand is slightly greater than the diameter of the largest journal to be supported.

Chains are often used to pick up a tire when placing it on a wheel center but a more convenient way is to use a clamp such as the one shown. This clamp is simply

Welded pipe stand for supporting mounted wheels

a piece of heavy material which can be flame-cut to size. The two ends are drilled and tapped for the set screws which hold it on the tire. The hole at the top center is 1½ in. in diameter and the hook is made of 1-in. round bar. One end of the hook goes through the hole in the clamp and the other fits over the crane hook.

The bracket for supporting the tire while it is being heated is made from ¾-in. plate with a ¾-in. U-bolt around the wheel spoke to hold the bracket against the wheel rim. When the tire is placed on the bracket the set screw is tightened to force the tire onto the wheel center. Then the ring heater is put in position and as the tire is heated and expands it will gradually slip onto the wheel center. A chain around a spoke with a bar through the chain can be used to force the tire onto the center or light blows with a sledge will help if it sticks. Once the tire is in the proper position two U-shaped clamps plus the set screw in the top bracket will hold it in position while cooling. The U-shaped clamps are made from 2-in. square stock, bent to shape and drilled and tapped for ⅞-in set screws. The clamps have three set screws, one of which is set against the inside of the wheel rim, another against the outside of the rim and a third against the outside face of the tire.



The bracket for supporting the tires while being heated, and the U-clamp for holding them in position are shown in the left-hand photograph; the clamp for lifting the tire is seen in the other illustration

Boiler and Shop Applications of

Oxy-Acetylene Welding*

THE scope of applications of oxy-acetylene welding in the locomotive boiler field has broadened considerably since our committee's last report. New developments have been made that are remarkable for their economy of both time and cost.

The use of oxy-acetylene welding for repairing defective parts, restoring worn surfaces and fabricating new equipment

Firebox Sheets

The repairing, patching and replacement of stayed firebox sheets including the firebox crown and side sheets, door, combustion-chamber and tube sheets by welding has long been an acceptable practice under the I. C. C. regulations. The establishment of this practice was based on the staybolted support of the sheets and the fact that the safety of these parts is not considered to be dependent primarily upon the welds by which they are joined. As a result of experience certain limitations have been imposed upon the extent of welding that is permissible in such staybolted sheets, such as the length of the welded patch seam, the extent of area that can be built up by welding over corroded spots and the location of welded longitudinal seams at any point higher than 12 in. below the top of the crown sheet. Despite these limitations, however, methods and procedures have been established by which the ordinary routine repairing of all of these parts, including removing and replacing of sections of the side, combustion chamber, door and tube sheets can be accomplished with the utmost facility and economy.

There are many cases where only a part of a side sheet is found corroded to the point of necessitating renewal and the rest of the firebox sheets, including the crown sheets, are capable of rendering further service. Cutting and welding permits that corroded part of the side sheet to be replaced with a minimum of delay and cost. With the oxy-acetylene torch or blowpipe, any desired portion of a sheet may readily be cut away and when the new sheet is formed and trimmed to the required shape and size, it can be welded in place of the part removed. Both the edges of the new sheet and of the plate left in place are readily veed by a cutting torch or blowpipe and then aligned for welding. The welds in these cases are of the single-V type and are made from the firebox side. The welding of such seams should be carried along continuously without stopping or delay when once started. This form of side-sheet repair has proved so successful during the past few years that it has caused a great reduction of complete firebox replacements.

New Fireboxes

When a complete new firebox is to be installed in a boiler it will be, in most railroad shops, a completely welded firebox with longitudinal welds between crown sheet and side sheets kept 12 in. below the level of the crown sheet. Transverse welds are permitted between the crown sheet and the door sheet and also between the crown sheet and the front flue sheet or combustion chamber. The sheets are accurately cut to size and formed before being brought to the erecting floor for welding. The veed edges of the sheets are then aligned and clamped in position with the proper spacing for welding; in some instances they also may be tack welded. The welding should be performed progressively in such a manner as to avoid bulging or warping of the sheets at the end of a seam and the welding of a seam, when once started, should be carried on continuously to completion without stopping or delay. The welds should be of the double-V type or the equivalent. The door-hole opening should be formed preferably to permit butt welding of the flanged-in edges of the sheets, or an offset or curved inserted sheet may be used with a butt-welded attachment to the door sheet and an arrangement for lap welding to the outer sheet flange. Where syphons are installed they should be fitted into the crown sheet with butt welds, while at the front flue sheet the necks of the syphons should be welded to the diaphragm plate with a corrugation to accommodate expansion and contraction.

Flue Sheets

Flue sheets also occasionally require renewal and it was formerly the practice to replace the entire sheet which involved a large amount of work in removal of connections, stays, diagonal braces, etc. Now it is customary to cut out and replace only such part of the flue sheet as has been affected by corrosion, or by overrolling of the flues. The inserted section is carefully fitted and the edges veed for welding in much the same manner as for a side-sheet patch. Where the section extends to either side, the edge of the sheet is flanged like the edge of a flue sheet and then the flange is bolted through the rivet holes into position which helps greatly in aligning the sheet for welding. Where an entire upper part of a flue sheet is to be replaced, the upper weld is located between the top row of flue holes and the bottom row of boiler braces. Where welds are carried across flue holes, the flue holes may be welded in solid and then drilled after welding or the holes may be trimmed by the gas-cutting torch or blowpipe to the approximate size and then reamed to the finished size.

Repairing Cracks

Cracks are successfully welded shut in firebox sheets provided it is possible to offset or otherwise deform the sheet on either side thereof so as to allow for the contraction after welding. These cracks often extend through staybolt holes, which tends to indicate that the sheet has been subject to stress at that point. In such cases it is more necessary than otherwise to bend or offset

* Abstract of the second part of a report presented at the annual meeting of the Master Boiler Makers' Association, October 22-25, 1940, at Chicago by a committee of the International Acetylene Association. This committee was composed of C. W. Obert, chairman, and J. H. Zimmerman, Linde Air Products Co., New York; F. C. Haase, The Oxweld Railroad Service Co., Chicago; R. F. Helmkamp and A. N. Kugler, Air Reduction Sales Co., New York, and E. A. Randall, Compressed Industrial Gases, Inc., Chicago. An abstract of the first part of this report appeared in the January, 1941, issue.

the sheet to a considerable extent before proceeding with the welding. The staybolt holes should be welded solid and then drilled after the welding has been completed. It is not desirable to repair a cracked sheet in this manner if the crack extends over two rows of staybolts in extent; when longer than this a patch should be inserted.

Welding Tubes

Extensive use has been made of oxy-acetylene welding in repairing and safe-ending both plain and superheater flues. In the case of plain flues, the prevailing practice has been to butt weld the safe ends whereas in superheater flues the safe-ends have been inserted and lap welded in certain instances. For butt welding, the safe-ends should be mounted and held in true alignment with the flue to be extended, the veed ends being separated by about $\frac{1}{16}$ in. Under these conditions very little reinforcement is permissible and it is, of course, essential that the welding be applied so as to leave the interiors of the tubes clear and smooth.

Pipe Welding

The welding of steel pipe, which has reached a very advanced stage of development in the industrial field, is rapidly coming into favor in locomotive erection and assembly work. While the piping used on a locomotive is of generally smaller size than that ordinarily encountered in industrial work, the importance of tightness has led to greatly increased use of welded joints and attachments. With welded joints and supporting brackets, dangerous sources of leakage are practically eliminated and the loosening of bolted or riveted connections is avoided entirely.

Most of the pipe-welding applications around the locomotive involve position welding but with customary oxy-acetylene welding practice, strong tight joints can be made of practically any size provided all sides of the pipe are accessible. The procedure in welding such pipe joints is somewhat different from that involved in the welding of plate and forgings but with the ordinary low-carbon steel materials usually encountered in pipe fabrication, no preheating or post heating is necessary. It is merely desirable to follow one of the established procedures that insures complete penetration without protrusions on the inside of the pipe and a reasonable amount of reinforcement on the outer surface.

Sheet-Metal Welding

Tenders, sheet-metal cabs, streamlining shrouds, etc., offer opportunities for oxy-acetylene welding applications that come within the range of the boiler-shop welding department. These embrace not only new construction of tender tanks and cabs, but also repairs and replacements of sheets, stiffeners or parts by sheet sections or patches. Oxy-acetylene welding permits of butt joints in the thinner gages with great facility, and this materially enhances the appearance of the finished work. In a few instances, tenders have been lengthened to afford greater capacity by gas cutting apart and inserting extensions of both underframe members and tank sheets by oxyacetylene welding.

Cast-Iron Welding

The welding and building up of cast-iron alloy, semi-steel and other gray-iron and gray-iron-alloy castings constitutes one of the major applications of the oxy-acetylene process. However, since the development of the bronze welding method, the use of cast-iron-alloy rods in welding and building up such parts is performed most extensively on gray-iron and gray-iron-alloy castings subject to temperatures higher than the melting point of bronze, such as superheater headers, dry pipes, throttle boxes, grates, fire bars, grate side frames, exhaust-nozzle stands, etc. Steam-hammer and forging-machine die blocks, forming dies and inserts and other parts, which must retain the original stiffness and direct characteristics of the gray iron or gray-iron-alloy material, are also welded or built up with cast-iron alloy rods. Surfaces of gray-iron castings, built up with the proper cast-iron alloy rod applied by the oxy-acetylene process, may be satisfactorily flame hardened by the newly developed oxy-acetylene flame-hardening process. Therefore, forming dies, forming-die inserts and many other parts made from gray iron are now being built up with cast-iron-alloy rod and flame hardened after the machining and finishing of the surfaces has been completed.

When the back cylinder heads are welded onto the cylinder castings, the welded joints will remain permanently leakproof

Bronze Welding

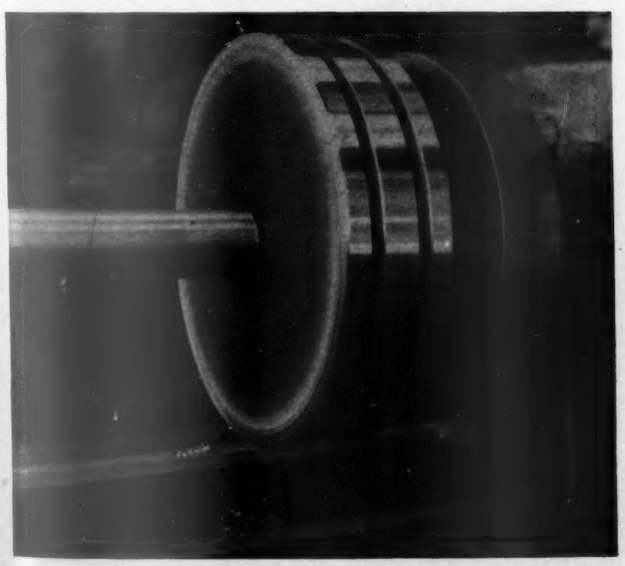
The relatively high strength and ease of application of modern bronze welding or brazing rods make this method particularly adaptable for the permanent joining or building up of gray-iron, gray-iron-alloy, semi-steel, bronze, brass, copper and certain other alloy parts, as well as parts made from various grades of steel. The bronze in the applied state is ductile, shock resisting and, as previously mentioned, of relatively high tensile strength. These factors, together with the ease of application and comparative low temperatures required for application has brought the bronze welding or brazing method into general practice on all railroads.

Bronze-welding applications in the locomotive shop include the following: The welding of broken gray-iron or gray-iron-alloy cylinder and saddle castings; air-pump castings; feed-water heater parts; feed-water-heater pump parts; certain stoker engine parts; bronze, brass or copper parts; the building up of locomotive piston heads; the building up of the wearing surfaces of cross-head shoes; the welding of steel back locomotive cylinder heads to gray-iron or gray-iron-alloy cylinder castings; the welding of gray-iron or gray-iron-alloy cylinder heads to steel cylinder castings and a very large number of additional parts which time will not permit mentioning.

Though the heat required to apply bronze rods is less than is required to apply cast-iron or steel welding rods, it is important that complicated parts, such as locomotive cylinders, air-pump cylinders, feed-water-heater castings, etc., be properly preheated prior to bronze welding to control the expansion and contraction stresses which may develop. In the instance of locomotive cylinders it is, of course, not necessary to preheat the part to as high a temperature as would be required if cast-iron-alloy rod were to be used but the same general precautions must be taken insofar as the actual preheating is concerned. A reasonably tight furnace must be constructed around the cylinder and provision made to preheat the unit slowly and evenly to the required temperature. After the bronze welding has been completed, the unit should again be evenly reheated, the furnace closed tightly and allowed to remain until the welded unit is practically cold. Make-shift methods such as improperly constructed baskets and light sheet metal or asbestos paper coverings should not be used in the preheating of complicated parts such as locomotive cylinders as it would be very difficult to control the preheating of the unit properly with a make-shift set-up of this kind. The bronze welding of a back locomotive cylinder-head casting requires the same precautions insofar as preheating is concerned as the welding of a break of similar proportion in the same location.

Another important use of bronze welding is for building up missing sections such as broken gear teeth or other parts that are broken off and lost, the building up or renewal of bearing and wearing surfaces, the renewing and refitting of threaded connections, etc. For gear teeth replacements and the renewal of wearing surfaces special compositions of bronze welding rod are available that will show remarkable strength and wear resistance in subsequent operation. In the building up of gear teeth it is common practice to form carbon blocks to fit the contour of the teeth and use them as molds between which the bronze rod is inserted and welded into place; this requires careful control of the building up operation in order that the molten metal may be deposited under perfect control.

In these building-up operations, preheating is often a great aid to the successful deposition of the bronze on the worn surface. Where the bronze deposit is to be applied to a journal bearing, it is often desirable to remove the surface by a roughing cut or clip down to fresh metal, in order that a more secure bond may be obtained with the steel or iron base metal. Once the initial deposit is made upon this surface the bronze may be built up to as high an ultimate surface as may be desirable. These same considerations apply in the filling in of holes and bushings that have become worn, out-of-round or over size.



The bearing surfaces of this piston head have been built up by bronze welding—The bronze provides a high quality wear-resistant surface

Locomotive frames can be economically repaired by oxy-acetylene welding—The C-clamps hold the broken section in alignment

Hard Facing

Hard surfacing can be applied to advantage by oxy-acetylene welding the surfaces of superheater flues or smokebox parts that are subject to the abrasive cutting action of the cinders. The cinder guards that are attached to the goose necks of the superheater flues in the smokebox are examples; if these cut out too rapidly between shopping periods, it will be found advantageous to hard surface them—the same is true of the pointed ends of the return bends of superheater flues.

There are numerous wearing parts of the stoker mechanism that are worth while to protect by hard facing. Probably the most important of these are the wearing edges of the conveyor and elevator screws that are constantly subject to the abrasive wear of the coal. If worn too deeply, it is customary to weld on a strip of metal to true the screw and bring it up to size; then on the wearing edge a hard surfacing material is applied by the oxy-acetylene torch. The wearing edges of stoker shovels can be similarly treated. The results in added wear will pay a handsome return on the small investment in hard surfacing material.

Flame Hardening

An application of the oxy-acetylene flame that does not come under the cutting or the welding classifications, but is found to be increasingly valuable in the locomotive shop is that known as flame hardening. This is a process which utilizes the oxyacetylene flame to raise the temperature of the surface of an iron or steel body quickly to a point that will insure hardening of that area upon cooling. It is applicable to most steels that have a carbon

content of .35 per cent or more, the steels which are most readily hardened being those that have a carbon range of from .40 to .70 per cent. Steels with a carbon content higher than .70 per cent must be treated with great care in hardening to avoid surface checking or cracking. Pearlitic cast irons and malleable irons also offer opportunities for hardening to increase their resistance to wear.

Applications of flame hardening have been applied in many different ways, including the hardening of a localized area or spot, the hardening of a certain straight line area by progressive movement of the flame along that line and by the rotary progressive method which involves the rotation of cylindrical objects under the flame. In all of these cases the amount of input that is required is only that necessary to bring the temperature of the surface to be hardened up to the critical point after which the surface is allowed to cool by the quenching effect of the adjacent steel or iron. Such hardening is easily applied to either smooth or irregular contours and with very little practice the average operator can perform very satisfactory work. Care must be taken, however, properly to regulate and coordinate the movements of the flame in order to insure satisfactory results.

Locating Keyways on Locomotive Axles

A method of locating the keyways in a driving axle exactly 90 deg. apart is illustrated in the accompanying drawings. Except for an additional V-block, the required equipment is shown in Fig. 5. The two V-blocks are made of sufficient size to hold the largest driving axles and have holes, drilled and reamed to the same diameter, as indicated in the drawing. The hole through the V-face of the block must be on the center line of the block with its axis directly below and parallel to the bottom of the Vee. A rod is turned to have a nice fit in these holes and to this rod is fitted a sliding bushing which holds a surface gage. The bottom of the V-block is made with a lug to fit the slot in the table of the milling machine.

To use this device, the axle is placed on the V-blocks and clamped down. The milling cutter is centered as shown in Fig 1, where *B* equals *A* minus one-half the width of the keyway, and the first keyway is cut. Then, a combination square is set on the table, Fig 2, and the line *C* is drawn between two points on a circle scribed on the end of the axle. The axle is next rotated on the V-blocks until the line *C* is approximately horizontal as indicated in Fig. 3. Line *C* is made horizontal, Fig. 4, by turning the axle until the scriber passes through both intersections of the line *C* with the circle when the gage is set at one radius. The milling cutter is centered at the other end of the axle by the method shown in Fig. 1 and the second keyway is cut. This procedure assures the cutting of the second keyway exactly 90 deg. from the first.

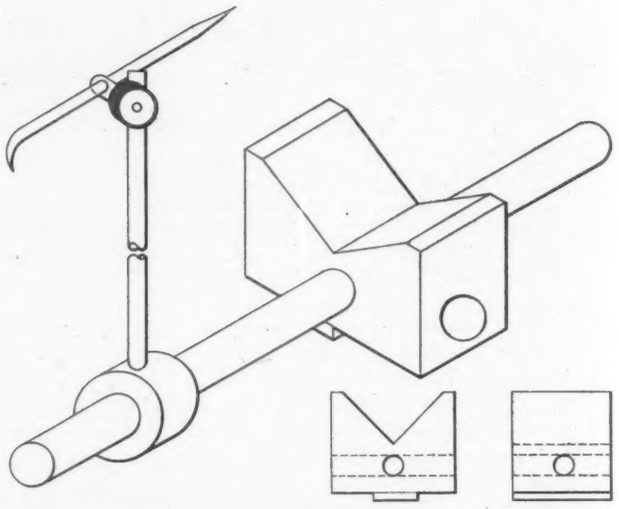


Fig. 5

Patch Designed to Enter Boiler Through Dome

The locomotive to which the patch shown in the accompanying drawing was applied came into the back shop for the sole purpose of having the shell patched at the water-pump bracket studs. The tubes had about two more years of service before they were scheduled for removal. The condition of the front and back flue sheets and the diaphragm plate was good.

The patch was designed to permit the inside welt to enter through the top of the steam dome. To allow a man inside the boiler plenty of room in which to work, a minimum number of flues were removed. The patch was laid out directly on the shell to make sure there would be no interference with studs and seams not shown on the boiler drawing. The location of rivets

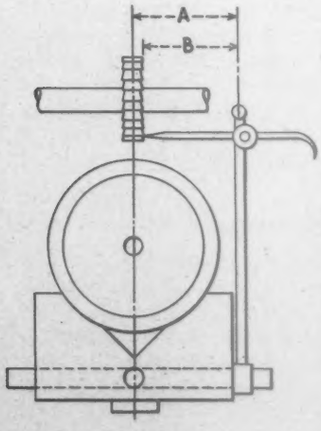


Fig. 1

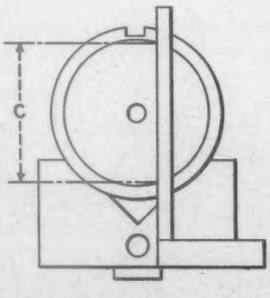


Fig. 2

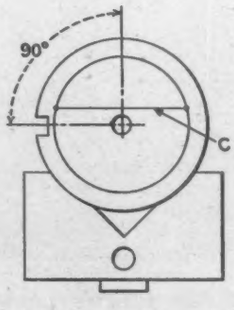


Fig. 3

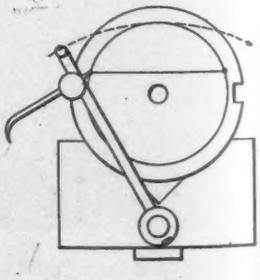
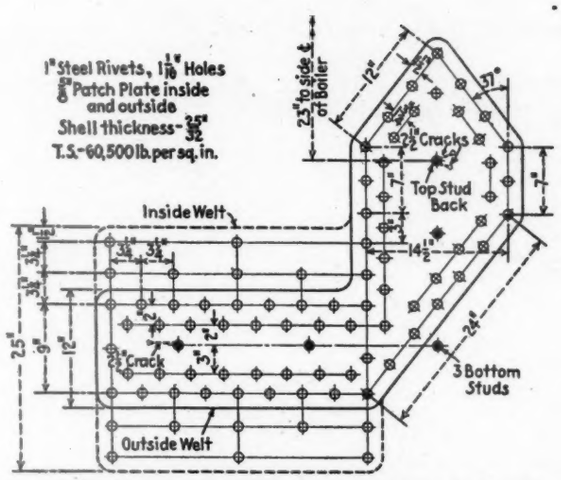


Fig. 4



Patch at the water-pump bracket studs shaped to permit the entrance of the patch through the steam dome

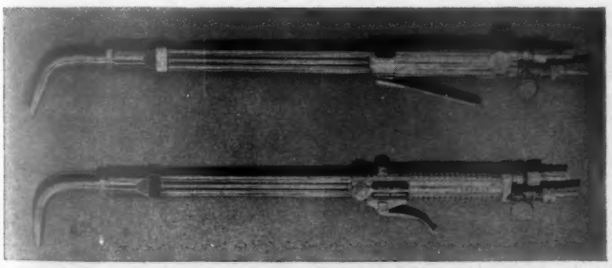
and spacing was made to meet the safety requirements prescribed by law.

It was deemed unnecessary to cover the lower back stud at the time the patch was applied. To do this would have required a larger inside welt which could not be entered through the dome without rolling the welt up to some extent. Such a procedure was not considered good practice.

Cutting Torches for Removing Riser Heads

In response to an increasing demand for greater convenience in removing riser heads from metal castings, Air Reduction, New York, has just introduced a new line of hand-cutting apparatus consisting of two torches and three tips. The new torches, styles 3180 and 9080, are of the straight-head type. Both have Monel metal heads and stainless-steel tubes for longer life; each is 21 in. in length. Cutting oxygen can be controlled by either a lever or a trigger and the type selected can be placed on the top, on either side, or on the bottom of the torch to suit the convenience and comfort of the individual operator.

The cutting tips are known as Style 187, bent to 75 deg., Style 181, bent to 90 deg. and Style 191, which

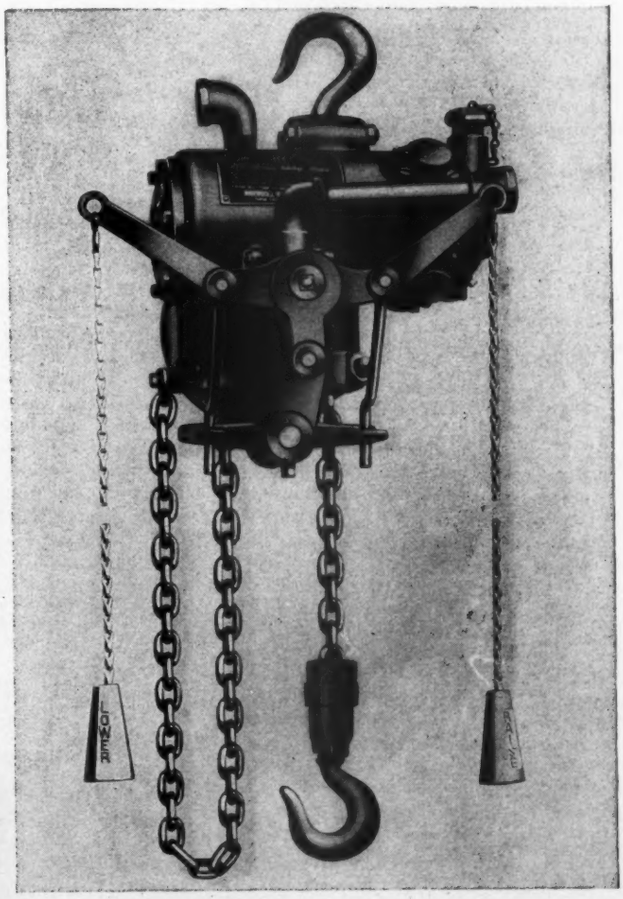


These Airco torches and cutting tips are designed especially for cutting risers from metal castings

is a straight tip 7 in. long. Style 191 is not shown in the illustration. These tips are designed for greater maneuverability in the restricted area and cramped quarters frequently encountered in riser cutting. The shorter length from the end of the tip to the bend makes this possible. While designed especially for cutting risers, this apparatus may also be used successfully for removing rivets, for construction and repair jobs and as standard hand torches for regular and other special applications.

Air Hoist for Light Lifting Work

For hoisting light loads up to 700 lb., the Ingersoll-Rand Company, Phillipsburg, N. J., has introduced the Air-Bloc. It is a flexible, welded, link-chain air hoist designed for use in machine shops, assembly lines, maintenance shops and shipping and receiving departments. This hoist is available in three sizes identified as LC-3, LC-5 and LC-7 whch will handle loads of 300, 500 and 700 lb., respectively.



The Ingersoll-Rand Air-Bloc for hoisting light loads up to 700 lbs.

The Air-Bloc weighs less than 75 lb. and can easily be moved from one job to another. An automatic up and down stop control prevents damage to the hoist from over-run of the chain in either direction. Another safety feature prevents the load from dropping even if the air supply fails.

This hoist is powered by a four-cylinder radial type air motor which cannot be injured by overloading. Throttle control is sensitive, permitting easy and positive spotting of the load.

High Spots in
Railway Affairs . . .

De Luxe Coach Trains Popular

The coach trains that were placed in operation between Chicago and Miami, Fla., last December have proved so popular that it has been decided to continue their operation from April through May. It is even intimated that they may be continued throughout the year. These trains, which include the Dixie Flagler, the City of Miami and the Southwind, are operated over nine railroads which comprise three Chicago-Florida routes. Since December they have handled approximately 100,000 passengers, with consistently full loadings, and with bookings two weeks in advance. Although the fare is low, $41.85 for the round trip from Chicago, these trains are said to have earned close to three dollars a mile.

St. Lawrence Seaway Project

The Railroad Co-operative League of Michigan, Prudden Building, Lansing, Mich., has for a long time done a yeoman's job of combating the so-called St. Lawrence Seaway. Its aggressive educational campaign has "sold" the fallacy of this project to the people of Michigan. Recently it has been active in the distribution of several short pamphlets. One of these was a reprint of an article by Prof. L. H. Haney of New York University, entitled, The St. Lawrence Project—Why and Why Now. Another one prepared by the League itself is entitled, The Fictitious Glamour of the St. Lawrence, and still another discusses those segments of the population that will be injured by this project. The League is also distributing a fourth pamphlet, entitled, Expense Without Recompense which was prepared by the National St. Lawrence Project Conference.

Proud of Railroad Performance

The railroads can well afford to take pride in the high efficiency that they attained during the year 1940. It is briefly summed up in the following items enumerated by J. J. Pelley, president of the Association of American Railroads. (1) The average amount of freight carried per train was greater than ever before on record. (2) Freight was transported over the rails at an average speed never surpassed and approximately 62 per cent higher than 20 years ago. (3) Freight train performance per hour was approximately twice as good as that of 1921. (4) Freight locomotives attained a new high mark in average daily mileage. (5) Utilization obtained from freight cars was greater than ever before. (6) Fuel efficiency in freight service was higher than ever before. (7) Number of freight cars in need of repair was lowest on record.

Railroad Fan Visits Halted

The national defense program, which is now getting well under way, has made it necessary for the industries concerned to take measures to guard against sabotage. The railroads, because of the vital part that they play, have been tightening up their regulations in various ways, in order to safeguard their properties and operations. President J. J. Pelley, of the Association of American Railroads, recently made the suggestion that member roads withhold permission to inspect facilities, from aliens or citizens not duly accredited by appropriate governmental agencies. Apparently this was so construed that it was responsible for the cancellation of a projected trip of the Washington Division of The Railroad Enthusiasts, to visit the Southern's roundhouse at Alexandria, Va. Whether it will be responsible for eliminating all fan trips for the time being, remains to be seen.

N. C. & St. L. Going to School

"Although many things are required to run a railroad well," says Fitzgerald Hall, president of the Nashville, Chattanooga & St. Louis, "nothing can take the place of man-power in the form of highly trained men and women who are interested in the individual and co-operative effort that brings success to the company for which they work." This is the thought behind an extensive educational program that is being inaugurated by that road. It is intended to familiarize the employees with the function and operation of the railroad, and the course will consist of a combination of mail and class instruction. The part of the program now projected includes four sections—historical, corporate, organization and principles of transportation. It will be in charge of W. Way, Jr., with the title of executive assistant.

By Hook Or Crook

President Roosevelt, realizing that he could not get the necessary votes in the Senate to make a treaty with Canada for the St. Lawrence seaway, on March 19 announced that a joint agreement had been made with the Canadian government. This will be submitted to Congress and requires only a majority vote to make it effective. The project, of course, cannot be completed in time to be of use in the present conflict, unless it extends beyond 1945, when it is anticipated that the proposed improvements will be completed. Certainly the pushing of this project cannot be warranted on any basis of sound economics. It would seem to be high time that the taxpayers put a stop to such useless and colossal expenditures that are not required for national defense and threaten to drag us into bankruptcy.

Transportation Board

The Transportation Act of 1940, which was signed by President Roosevelt on September 18, last, provided for the appointment of a board whose duty is "to investigate the relative economy and fitness of carriers by railroad, motor carriers, and water carriers for transportation service, or any particular classes or descriptions thereof, with the view of determining the service for which each type of carrier is especially fitted or unfitted." It also indicated that a study should be made of the methods by which each type of transportation can and should be developed to provide an adequate national transportation system. The board was instructed to transmit preliminary reports of its studies and investigations to the President and to Congress on or before May 1, 1941.

The President finally got around to appointing the board and on March 20 named Wayne Coy, Charles West and Nelson Lee Smith. Coy is an assistant administrator of the Federal Security Agency under Paul V. McNutt, and is regarded as one of his cronies. West was a teacher of political economy for many years and more recently has been an under-secretary in the Department of the Interior. He is more popularly known as the person who has been acting as a liaison between the White House and Congress. Smith is designated as an independent in politics. He also got his start as a teacher of economics in several of our colleges, and since 1934 has been a member and chairman of the New Hampshire Public Service Commission. He, at least, has had some practical experience in the field of transportation as a public servant.

Among the Clubs and Associations

Fuel and Traveling Engineers Program Well Along

Most of the items for the program of the annual meeting of the Railway Fuel and Traveling Engineers' Association, to be held at the Hotel Sherman, Chicago, Tuesday and Wednesday, September 23 and 24, have been definitely settled. The items now established include the following:

Fuel Economy from the Viewpoint of the Water Engineer, by R. C. Bardwell, superintendent water supply, C. & O.

Locomotive Performance as Affected by Steam Distribution (Valve Setting), J. L. Ryan (chairman), mechanical engineer, St. L.-S. F.

Safety and Its Relation to Fuel Conservation. Address by L. Richardson, mechanical assistant to vice-president and general manager, B. & M.

New Locomotive Economy Devices, A. G. Hoppe (chairman), assistant mechanical engineer, C. M. St. P. & P.

Utilization of Motive Power, A. A. Raymond (chairman), superintendent fuel and locomotive performance, N. Y. C.

Plugged Netting—Causes and Cures, H. Malette (chairman), road foreman of equipment, St. L.-S. F.

Turbine and Condensing Locomotives, L. P. Michael (chairman), chief mechanical engineer, C. & N. W.

The Road Foreman and the Diesel Locomotive, W. D. Quarles (chairman), general mechanical instructor, A. C. L.

Lubrication of Locomotives, W. R. Sugg (chairman), superintendent fuel conservation and lubrication, Mo. Pac.

Air Brakes, J. A. Burke (chairman), supervisor air brakes, A. T. & S. F.

Fuel Records and Statistics, E. E. Ramey (chairman), fuel engineer, B. & O.

Coal—Utilization of the various sizes, S. A. Dickson (chairman), supervisor fuel, Alton.

Car Department Officers at Work on Fall Meeting Program

E. B. Hall, chief mechanical officer, C. & N. W., and D. S. Ellis, chief mechanical officer, C. & O., are expected to address those in attendance at the meeting of the Car Department Officers' Association to be held at the Hotel Sherman, Chicago, Tuesday and Wednesday, September 23 and 24. Reports are under preparation by the following committees:

Maintenance of High-Speed Passenger Brakes, J. E. Keegan (chairman), chief car inspector, Pennsylvania.

Car Shop Operation, Facilities and Tools, A. Herbster (chairman), foreman car department, N. Y. C.

Passenger-Train-Car Terminal Handling — Water-Cooled Air-Conditioning Condensers, R. K. Betts (chairman), foreman car repairs, Pennsylvania.

Lubricants and Lubrication—Journal-Box Packing, J. R. Brooks (chairman), supervisor lubrication and supplies, C. & O.

Uniform Commodity Requirements and Commodity Cards, H. E. Wagner (chairman), general car foreman, Mo. Pac.

Interchange and Billing for Car Repairs, E. G. Bishop (chairman), general foreman car department, Illinois Central.

A. A. R. Loading Rules, H. T. DeVore (chairman), chief interchange inspector, Youngstown Car Inspection Association.

Painting, E. W. Grimminger, foreman painter, car department, Pennsylvania.

Locomotive Maintenance Officers' Annual Meeting Program

Reports on several subjects have been definitely assigned to the program of the Locomotive Maintenance Officers' Association for its annual meeting to be held at the Hotel Sherman, Chicago, on September 23 and 24, and the preparation of reports on the following subjects are now under way:

Maintenance of Air-Brake Equipment, J. P. Stewart (chairman), general supervisor air brakes, Mo. Pac.

Apprenticeship, Roy V. Wright (chairman), editor, *Railway Mechanical Engineer.*

Improved Locomotive Repair Practices, N. M. Trapnell (chairman), assistant superintendent motive power, C. & O.

Lubrication, J. R. Brooks (chairman), supervisor lubrication and supplies, C. & O.

It is also planned to have reports on the Care and Maintenance of Shop Tools and Safety.

Five Subjects on Boiler Makers' Annual Meeting Program

Committees have been chosen and are already at work on five subjects for presentation at the two-day meeting of the Master Boiler Makers' Association to be held September 23 and 24 at the Hotel Sherman, Chicago. The subjects are as follows:

Topic No. 1—Shop Kinks and New Ways of Doing Things in the Boiler Shop, S. Christopherson (chairman), supervisor of boiler inspection and maintenance, N. Y. N. H. & H.

Topic No. 2—Application and Maintenance of Flues, Tubes, and Arch Tubes, Frank A. Longo (chairman), general boiler foreman, Southern Pacific.

Topic No. 3—Treating Feedwater Chemically, Carl A. Harper (chairman), general boiler inspector, C. C. C. & St. L.

Topic No. 4—Application and Service of Straight vs. Tapered Radial Staybolts (including iron, steel and alloy material), R. W. Barrett (chairman), chief boiler inspector, Canadian National.

Topic No. 5—Application of Iron Steel and Alloy Rivets, A. G. Trumbull (chairman), chief mechanical engineer, Advisory Mechanical Committee, C. & O.

DIRECTORY

The following list gives names of secretaries, dates of next regular meetings, and places of meetings of mechanical associations and railroad clubs:

ALLIED RAILWAY SUPPLY ASSOCIATION.—J. F. Gettrust, P. O. Box 5522, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—C. E. Davies, 29 West Thirty-ninth street, New York.

RAILROAD DIVISION.—C. L. Combes, *Railway Mechanical Engineer*, 30 Church street, New York City.

MACHINE SHOP PRACTICE DIVISION.—Warner Seely, Warner & Swasey Co., 5701 Carnegie avenue, Cleveland, Ohio.

MATERIALS HANDLING DIVISION.—F. J. Shepard, Jr., Lewis-Shepard Co., Watertown Station, Boston, Mass.

OIL AND GAS POWER DIVISION.—L. N. Rawley, Jr., Power, 330 West Forty-second street, New York.

FUELS DIVISION.—D. C. Weeks, Consolidated Edison Co., 4 Irving Place, New York.

ANTHRACITE VALLEY CAR FOREMEN'S ASSN.—Exec. sec., Walter B. Riggin, 215 Swartz street, Dunmore, Pa. Meets third Monday of each month at Wilkes-Barre, Pa.

ASSOCIATION OF AMERICAN RAILROADS.—Charles H. Buford, vice-president Operations and Maintenance Department, Transportation Building, Washington, D. C.

OPERATING SECTION.—J. C. Caviston, 30 Vesey street, New York.

MECHANICAL DIVISION.—A. C. Browning, 59 East Van Buren street, Chicago. Meeting at Hotel Jefferson, St. Louis, Mo., June 19 and 20.

PURCHASES AND STORES DIVISION.—W. J. Farrell, 30 Vesey street, New York.

MOTOR TRANSPORT DIVISION.—George M. Campbell, Transportation Building, Washington, D. C.

CANADIAN RAILWAY CLUB.—C. R. Crook, 4415 Marcil avenue, N. D. G., Montreal, Que. Regular meetings, second Monday of each month, except June, July and August, at Windsor Hotel, Montreal, Que.

CAR DEPARTMENT ASSOCIATION OF ST. LOUIS.—J. J. Sheehan, 1101 Missouri Pacific Bldg., St. Louis, Mo. Regular monthly meetings third Tuesday of each month, except June, July and August, DeSoto Hotel, St. Louis.

CAR DEPARTMENT OFFICERS' ASSOCIATION.—Frank Kartheiser, chief clerk, Mechanical Dept., C. B. & Q., Chicago. Annual meeting, Hotel Sherman, Chicago, September 23 and 24.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 8238 S. Campbell avenue, Chicago. Regular meetings, second Monday in each month, except June, July and August, La Salle Hotel, Chicago.

CAR FOREMEN'S ASSOCIATION OF OMAHA, COUNCIL BLUFFS AND SOUTH OMAHA INTERCHANGE.—H. E. Moran, Chicago Great Western, Council Bluffs, Ia. Regular meetings, second Thursday of each month.

CENTRAL RAILWAY CLUB OF BUFFALO.—Mrs. M. D. Reed, Room 1817, Hotel Statler, Buffalo, N. Y. Regular meetings, second Thursday of each month, except June, July and August, at Hotel Statler, Buffalo.

EASTERN CAR FOREMEN'S ASSOCIATION.—W. P. Dizard, 30 Church street, New York. Regular meetings, second Friday of January, February, March, April and October at Engineering Societies Bldg., 29 West Thirty-ninth street, New York.

INDIANAPOLIS CAR INSPECTION ASSOCIATION.—R. A. Singleton, 822 Big Four Building, Indianapolis, Ind. Regular meetings, first Monday of each month, except July, August and September, in Indianapolis Union Station, Indianapolis, at 7 p. m.

LOCOMOTIVE MAINTENANCE OFFICERS' ASSOCIATION.—J. E. Goodwin, general foreman, locomotive department Missouri Pacific, North Little Rock, Ark. Meeting September 23 and 24, Hotel Sherman, Chicago.

MASTER BOILER MAKERS' ASSOCIATION.—A. F. Stiglmeier, secretary, 29 Parkwood street, Albany, N. Y. Annual meeting, Hotel Sherman, Chicago, September 23 and 24.

MID-WEST AIR BRAKE CLUB.—C. R. Ehni (secretary-treasurer), mechanical inspector, St. Louis-San Francisco, Springfield, Mo.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic avenue, Boston, Mass. Regular meetings, second Tuesday in each month, except June, July, August and September.

NEW YORK RAILROAD CLUB.—D. W. Pye, Room 527, 30 Church street, New York. Meetings, third Thursday in each month, except June, July, August, September and December at 29 West Thirty-ninth street, New York.

NORTHWEST CAR MEN'S ASSOCIATION. — E. N. Myers, chief interchange inspector, Minnesota Transfer Railway, St. Paul, Minn. Meetings, first Monday each month, except June, July and August, at Midway Club rooms, 1931 University avenue, St. Paul.

NORTHWEST LOCOMOTIVE ASSOCIATION.—G. T. Gardell, 820 Northern Pacific Building, St. Paul, Minn. Meetings last Monday of each month, except June, July and August.

PACIFIC RAILWAY CLUB.—William S. Wollner, P. O. Box 3275, San Francisco, Cal. Monthly meetings alternately in northern and southern California.

RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 1647 Oliver Building, Pittsburgh, Pa. Regular meetings, fourth Thursday in month, except June, July and August, Fort Pitt Hotel, Pittsburgh, Pa.

RAILWAY FUEL AND TRAVELING ENGINEERS' ASSOCIATION.—T. Duff Smith, Room 811, Utilities Building, 327 South La Salle street, Chicago. Annual meeting Hotel Sherman, Chicago, September 23 and 24, 1941.

RAILWAY SUPPLY MANUFACTURERS' ASSOCIATION.—J. D. Conway, 1941 Oliver Building, Pittsburgh, Pa.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings, third Thursday in January, March, May, July and September. Annual meeting, third Thursday in November, Ansley Hotel, Atlanta, Ga.

TORONTO RAILWAY CLUB.—D. M. George, Box 8, Terminal A, Toronto, Ont. Meetings, fourth Monday of each month, except June, July and August, at Royal York Hotel, Toronto.

WESTERN RAILWAY CLUB.—W. L. Fox, executive secretary, Room 822, 310 South Michigan avenue, Chicago. Regular meetings, third Monday in each month, except June, July, August and September.

One of two 6,000-hp. Diesel-electric locomotives for use on the new City of Los Angeles and City of San Francisco streamliners

NEWS

B. & O. Mechanics on Six Day Week

THE Baltimore & Ohio has placed all mechanics on its system on a six-day, 48-hour week. The change from the present five-day, 40-hour-week basis, in effect since 1932, affects between 12,000 and 15,000 men. Straight time is paid for six days and time-and-a-half for Sundays and holidays.

U. P. Tests Locomotives for Diesel-Electric Trains

THE first of two Diesel-electric passenger locomotives which will be used on the new City of Los Angeles and City of San Francisco has been delivered by the builder, the Electro-Motive Corporation, and has been under test on the Union Pacific. Each of the locomotives consists of three separate units having two 1,000-hp. engines with a combined rating of 6,000 hp. The overall length of the three units is 209 ft. and the weight 945,000 lb. The wheels of the new locomotives are kept cool during brake applications on long grades by an automatic water spray.

One of the locomotives will be used on the City of Los Angeles of the Union Pacific-Chicago & North Western between Chicago and Los Angeles, Cal., and the other will be used on the City of San Francisco of the Union Pacific-Chicago & North Western-Southern Pacific between Chicago and San Francisco, Cal. Fifteen streamline passenger-train cars will be used on each of these trains, of which 28 will soon be delivered by the Pullman-Standard Car Manufacturing Company.

Lehigh Valley Offers Shop Facilities for Defense Work

PRESIDENT Albert N. Williams of the Lehigh Valley has informed the Office of Production Management of the National Defense Advisory Commission that the road offers the facilities of its Sayre (Pa.) locomotive and car shops to the government for use during hours of the day when they are not in use by the railroad. At present the Lehigh Valley operates one shift of eight hours, and can therefore turn over use of the machinery and buildings to the government for 16 hours out of each 24.

Expediting Rail Movement of Freight Into Army Camps

THE War Department has announced the completion of plans by the Commercial Traffic Branch of the Quartermaster Corps to facilitate the movement into, around, and out of Army posts, camps and stations, the "many thousands of freight cars which will be needed to carry supplies and equipment for an Army of 1,418,000 men."

The steps necessary to accomplish this task, the statement says, involve up-to-the-minute surveys of operations and quick deliveries of locomotives to 56 camps and army posts throughout the country. Cited as examples of the problems to be met are Fort Bragg in North Carolina, where about 5,000 cars will be handled each month; Camp Blanding, Florida, where 50,000 troops will be encamped by June 15, anticipates 20 cars a day, and Camp Wolters, near Mineral Wells, Texas, will have 17,000 feet of railroad track, and 16,000 officers and men to serve by June 15. The last of 60 locomotives of various types and sizes for these army operations will be delivered by September at a cost of $1,400,000.

To expedite deliveries of locomotives for these operations, E. R. Stettinius, Jr., director of priorities of the Office of Production Management, has announced the inclusion in the government's priorities critical list of Diesel-electric, gasoline, and electric locomotives. Manufacturers receiving orders from either the Army or Navy will thus be required to complete them ahead of non-priority orders. The

(*Continued on next left-hand page*)

Orders and Inquiries for New Equipment Placed Since the Closing of the March Issue

LOCOMOTIVE ORDERS

Road	No. of Locos.	Type of Locos.	Builder
American Brass Co.	1[1]	45-ton fireless loco.	Heisler Loco. Wks.
Atchison, Topeka & Santa Fe	2	5,400-hp. Diesel-elec., frt.	Electro-Motive Corp.
	1	2,000-hp. Diesel-elec., pass	
Boston & Maine	3	380-hp. Diesel-elec.	General Electric Co.
Canadian National[2]	25	4-8-4	American Loco. Co.
Chicago & North Western	4	2,000-hp. Diesel-elec.	Electro-Motive Corp.
	1	2,000-hp. Diesel-elec.	American Loco. Co.
Chicago, Rock Island & Pacific	5	44-ton Diesel-elec.	Davenport-Besler Corp.
Cincinnati, New Orleans & Texas Pacific	2	5,400-hp. Diesel-elec. frt.	Electro-Motive Corp.
Connecticut Light & Power Co.	1	45-ton fireless loco.	Heisler Loco. Wks.
E. I. du Pont de Nemours Co.	2	400-hp. Diesel-elec.	Vulcan Iron Wks.
Lone Star Cement Corp.	2	180-hp. Diesel-mech.	Vulcan Iron Wks.
Missouri Pacific	2[4]	4,000-hp. Diesel-elec.	Electro-Motive Corp.
New York, New Haven & Hartford	10	660-hp. Diesel-elec.	American Loco. Co.
New York Shipbuilding Co.	1	0-4-0	Vulcan Iron Wks.
Norton Company	1[1]	85-ton fireless loco.	Heisler Loco. Wks.
Panama Railroad	3	Oil-burning steam	H. K. Porter Co.
St. Paul Union Depot	1	380-hp. Diesel-elec.	General Electric Co.
Southern Pacific	40[5]	Cab ahead	Baldwin Loco. Wks.
	10[5]	Daylight	Lima Loco. Wks.
	10[6]	Diesel-elec.	American Loco. Co.
	10[6]	Diesel-elec.	Electro-Motive Corp.
	5[6]	Diesel-elec.	Baldwin Loco. Wks.
U. S. Navy Dept.	6	300-hp. Diesel-elec.	General Electric Co.
	4	180-hp. Diesel-mech.	Vulcan Iron Works
U. S. War Dept.	6	300-hp. Diesel-elec.	
	5	35-ton Diesel-elec.	Davenport-Besler Corp.
	2	30-ton Diesel-mech.	
	15	20-ton gas.-mech.	
	4	300-hp. Diesel-elec.	General Electric Co.[3]
	3	400-hp. Diesel-elec.	

PHOTO BY LYNCH—CHICAGO

THESE CHILLED CAR WHEELS DELIVERED 153,000 MILES OF SERVICE

One of a number of pairs of chilled wheels removed after 153,000 miles of service from a series of 70,000 lb. refrigerator cars. These wheels were installed in 1931.

4 SAVINGS WITH CHILLED CAR WHEELS:

1. Lowest cost per mile.
2. Increased rail life.
3. Increased brake shoe life.
4. Reduced machine shop costs.

ASSOCIATION OF MANUFACTURERS OF CHILLED CAR WHEELS

230 PARK AVENUE,
NEW YORK, N. Y.

445 N. SACRAMENTO BLVD.,
CHICAGO, ILL.

AMCCW

ORGANIZED TO ACHIEVE:
Uniform Specifications
Uniform Inspection
Uniform Product

Orders and Inquiries for New Equipment—Continued

Freight-Car Orders

Road	No. of Cars	Type of car	Builder
American Refrig. Transit Co.	150	40-ton refrigerator	Company shops
Baltimore & Ohio	500	70-ton gondolas	American Car & Fdry. Co.
	500	70-ton gondolas	Bethlehem Steel Co.
	1,000	50-ton hopper	Gen. Amer. Trans. Corp.
	250	50-ton box	Pull.-Std. Car Mfg. Co.
	100	70-ton cement	Greenville Steel Car Co.
Bethlehem Steel Co.	14	100-ton flat	Company shops
Canadian National	250	70-ton hopper	Eastern Car Co.
	150	50-ton ballast	National Steel Car Corp.
	125	80-ton ore	
	200	Flat	Canadian Car & Fdry. Co.
	100	40-ton refrigerator	Company shops
Central of New Jersey	1,000	50-ton hopper	[8] Company shops
	50	Cement	
	50	Caboose	
Chesapeake & Ohio	25	70-ton flat	Ralston Steel Car Co.
	10	125-ton flat	Greenville Steel Car Co.
	10	125-ton well	
Chicago, St. Paul, Minneapolis & Omaha	700	50-ton box	American Car & Fdry. Co.
Denver & Rio Grande Western	10	Cabooses	Bethlehem Steel Co.
Lake Superior & Ishpeming	100[7]	50-ton ore	Bethlehem Steel Co.
Lehigh & New England	100[11]	70-ton hopper bottom	American Car & Fdry. Co.
Minneapolis, St. Paul & Sault Ste. Marie	100	50-ton flat	Pull.-Std. Car Mfg. Co.
	50	50-ton ballast	American Car & Fdry. Co.
New York, New Haven & Hartford	1,000[9]	Box	Pressed Steel Car Co.
Pere Marquette	100	50-ton box	Pull.-Std. Car Mfg. Co.
	100	50-ton box	American Car & Fdry. Co.
	100	50-ton box	Gen. Amer. Trans. Corp.
	100	50-ton box	Greenville Steel Car Co.
	100	40-ton automobile	Ralston Steel Car Co.
Phelps Dodge Corp.	80	90-ton air dump	Differential Steel Car Co.
John Roebling's Sons Co.	10	70-ton gondolas	American Car & Fdry. Co.
Southern Pacific	500[6]	50-ton box	Pressed Steel Car Co.
	500[6]	50-ton box	Gen. Amer. Trans. Corp.
	500[6]	50-ton box	Bethlehem Steel Co.
	500[6]	50-ton box	Pull.-Std. Car Mfg. Co.
	500[6]	50-ton box	Mt. Vernon Car Mfg. Co.
Tennessee Coal, Iron & R. R. Co.	90	70-ton ore	Pull.-Std. Car Mfg. Co.
	85	70-ton hopper	
Utah Copper Co.	75	Ore	Pressed Steel Car Co.
Wabash[10]	150	Automobile	Company shops
	50	Mill-type gondolas	
	15	Caboose	
Western Maryland	40	70-ton covered hopper	American Car & Fdry. Co.

Freight-Car Inquiries

Baltimore & Ohio	100	Caboose	.....
Canadian Pacific	250	50-ton hopper	.....
Chicago, Rock Island & Pacific	25	70-ton hopper-bottom gondolas	.....
U. S. Navy Dept., Bureau of Supplies and Accounts	6	70-ton flat	.....

Passenger-Car Orders

Chicago & North Western	3	Bagg.-taproom-lounge	Pull.-Std. Car Mfg. Co.
	14[12]	Coaches	
	4[12]	Diners	
	4[12]	Parlor	
Chesapeake & Ohio	20	Coaches	American Car & Fdry. Co.
Missouri Pacific	2	Diner-lounge	[4] Edw. G. Budd
	4	Coaches	
	2	Mail	
	2	Mail-bagg.	
	1	Reserve mail-bagg.	
	4	Spec. designed Pullman	Pull.-Std. Car Mfg. Co.
Norfolk & Western	15	Coaches	Pull.-Std. Car Mfg. Co.
Union Pacific	30	Chair	[13] Pull.-Std. Car Mfg. Co.
	30	Baggage	
	10	Bagg.-mail	

[1] Delivery received.
[2] For use of Grand Trunk Western Lines.
[3] U. S. War Dept. orders placed with General Electric so far this year includes four 45-ton Diesel-electric locomotives of 300 hp. and three 60-ton Diesel-electric locomotives of 400 hp.
[4] For two streamline trains for service between St. Louis, Mo., and Denver, Colo.
[5] Estimated cost of cab ahead and Daylight locomotives $11,000,000.
[6] In addition to the orders for 15 Diesel-electrics reported in the March issue. The total cost of the 40 Diesel-electric locomotives is estimated at $2,900,000. The 2,500 freight cars will cost approximately $9,000,000.
[7] Order not confirmed.
[8] Contracts authorized by court authority. Cost of equipment estimated at $2,670,587.
[9] Purchase authorized by court. Builder expected to be Pressed Steel Car Co.
[10] Asking for prices on parts to build this equipment.
[11] For bulk cement.
[12] Lightweight construction.
[13] Two coaches, a diner, and a parlor car for use on the Minnesota "400".

priorities critical list includes all fabricated parts necessary for the completion, maintenance or operation thereof, which are designed to meet military specifications and, as designed, are not commercially useful for ordinary civilian purposes.

D. L. & W. Releasing Mechanics for Defense

The Delaware, Lackawanna & Western is planning to work its shops full time as nearly as business will permit, according to President William White. About 200 employees of its mechanical department will thereby be released for work in defense industries; their railroad seniority rights will be preserved in the interim in accordance with their working agreement. The move is being made in accordance with a program of the National Defense Railway Industry Committee, consisting of management and labor representatives, which contemplates that railroads will determine shop programs for 1941, and on that basis arrange to work their forces as nearly full time as practicable so that men of the mechanical crafts not necessary for railroad work may be released to the defense industry and to other railroads.

Priorities for Machine Tools

Acting by virtue of authority granted the Executive in the National Selective Service Act of last year, E. R. Stettinius, Jr., director of priorities of the Office of Production Management, issued an order on February 24 which places aluminum producers and machine-tool builders under a mandatory priority status. The order, which expires on May 31, 1941, was put into effect to speed up the defense program and hasten the delivery of machine tools. It directs machine-tool makers to "serve all such defense orders in preference to any non-defense orders, in so far as this course is necessary to comply with the delivery dates on such defense orders."

1940 Operating Efficiency Record

New high records in operating efficiency were attained by the railroads in 1940, according to complete reports received for that year, J. J. Pelley, President of the Association of American Railroads, announced on March 11.

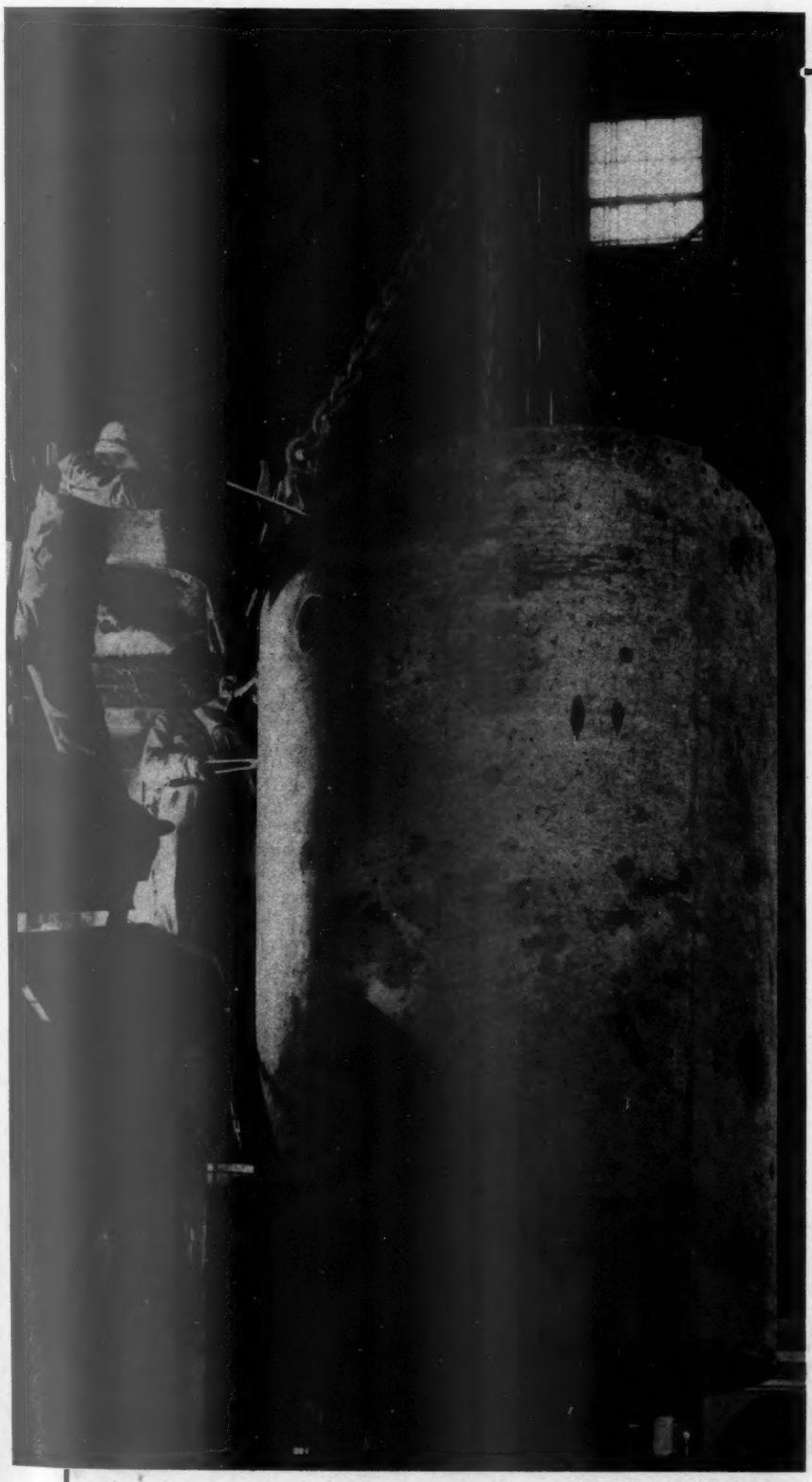
"The outstanding feature in railroad performance," Mr. Pelley said, "was the increase in the amount of freight that was carried per train, that average in 1940 having been 849 tons compared with 813 tons in 1939, and 804 tons in 1929, the year of heaviest traffic in the history of the railroads. Freight-train performance in 1940 was approximately twice that of 20 years ago. That is, gross ton-miles per train hour increased from 16,555 in 1921 to 33,808 in 1940, or 104 per cent, while net ton-miles per freight train hour increased from 7,506 in 1921 to 14,027 in 1940, or 87 per cent. These are new high records in both instances.

"Freight locomotives in 1940 operated a daily average of 107.2 miles, which also was a new high record. The average daily movement of all freight cars, which includes those being loaded and unloaded, was 38.7 miles in 1940 which also was a new high record. Net ton-miles per freight car per day was 661 ton-miles, also a new record. The previous record was established in 1937 with an average of 625 ton-miles per day.

"Fuel efficiency in freight service was never better than in 1940. Despite the increased weight per train and the increase that has taken place in recent years in the average speed of trains, the railroads in 1940 averaged 112 lbs. of fuel for the movement one mile of 1,000 tons of freight and equipment. This average has never before been attained. For each pound of fuel used in freight srvice in 1940, the railroads hauled 8 9/10 tons of freight and equipment one mile compared with 6 1/8 tons in 1921, or an increase of 44 per cent.

"Railroads in 1940 had an average of

(*Continued on next left-hand page*)



Guess-work is eliminated when riveting

LIMA BOILERS

Lima knows that every rivet that goes into a boiler has a grave responsibility and, therefore, the riveting pressure is carefully and accurately controlled.

Here is a "behind-the-scenes" view of the Lima bull-riveter. There is no guessing here as to whether the riveting pressure has done its job. Controls are automatically set to provide the proper riveting time and pressure which varies with the thickness of the plate and the size of the rivet.

This is just one of the numerous precautions taken at Lima to safeguard quality and build low maintenance into locomotives.

LIMA LOCOMOTIVE WORKS — LIMA LOCOMOTIVE WORKS INCORPORATED — INCORPORATED, LIMA, OHIO

144,249 unserviceable freight cars, the lowest number in need of repair on record. This was 7.9 per cent of ownership. Since then, this number has been further reduced with the result that on February 1 this year there were only 107,596 unserviceable cars, or 6.7 per cent of ownership.

". . . Taken as a whole, the year's performance was the best in railroad history."

L. B. Sherman, Senior Vice President of Simmons-Boardman Retires

LUCIUS (LOU) BOOTH SHERMAN, senior vice-president of the Simmons-Boardman Publishing Corporation, with headquarters at Chicago, has retired on pension after more than 50 years' association with the railroads and the railway supply industry.

Lucius Booth Sherman

During his career, Mr. Sherman has taken an active part in the Railway Manufacturers Supply Association and the National Railway Appliances Association, serving as a member of the executive committee of the former and a director of the latter for a number of years. In 1925 he was one of the American Railway Association's delegates to the International Railway Congress at London, England.

Mr. Sherman was born in Chicago on April 18, 1863, and after attending the University of Chicago, he immediately chose the selling phase of the publishing business for his career. In 1884 he entered the employ of the Railway Review and soon after rose to business manager of that publication. Later he resigned to become associated with the Railroad Gazette and on November 1, 1901, was promoted to western manager of that publication. In 1908 the Railway Age and the Railroad Gazette were merged into the Railroad Age Gazette and Mr. Sherman was elected vice-president of the new company on May 9, 1911. He continued as vice-president of the Simmons-Boardman Publishing Company, which was formed in 1912 to publish the Railway Age and several other railway publications, and later was made senior vice-president. In 1930 when the Simmons-Boardman Publishing Corporation was organized to take over the Railway Review, the Railway Age and other railway magazines and several papers in the building field, Mr. Sherman was elected senior vice-president of the new company.

Equipment Purchasing and Modernization Programs

Atchison, Topeka & Santa Fe.—The Santa Fe has awarded a contract to George Senne & Co., Topeka, Kan., for the construction of a car repair shed at West Wichita, Kan. The building will be 44 ft. wide by 450 ft. long and will have a structural steel frame, corrugated iron sides, and a wooden sheathing and composition roof. It will span two tracks and will be used for repairing freight cars. The total cost of the project will be approximately $120,000.

Baltimore & Ohio.—The board of directors of the B. & O. has approved the purchase of 2,400 freight cars, at an estimated cost of $7,500,000, and four Diesel-electric passenger locomotives of 4,000-hp. each, at an estimated cost of $1,400,000. The 2,400 freight cars comprise the following: 1,000 70-ton gondola cars, 1,000 50-ton hopper cars, 250 50-ton box cars, 150 70-ton cement cars. Orders for a total of 1,350 freight cars are reported elsewhere in this issue.

Canadian Pacific.—The Canadian Pacific is reported to be contemplating the purchase of twenty-five 4-6-2 type locomotives and an undetermined number, reported as twenty-five, 4-8-4 type locomotives.

Chicago, Indianapolis & Louisville.—The C. I. & L. is reported to be inquiring for nine baggage cars and one mail-baggage car.

Chicago, Milwaukee, St. Paul & Pacific.—The C. M. St. P. & P. has petitioned the district court for permission to purchase 16 Diesel-electric locomotives and to spend $7,306,290 for improvements and equipment purchases during 1941. The Diesel-electric locomotives include the following: two 1,000 hp., one 600 hp., ten 360 hp.,—for switching and light road service; two 4,000 hp.—for use on the "Hiawatha"; one 5,400 hp.—for main line freight service.

Among the improvements considered is the enlargement of enginehouses at Tacoma, Wash., and Madison, Wis. For new freight and passenger cars to be built in company shops, a total of $2,387,500 will be spent. Orders have been placed with company shops for the construction of 500, 50-ton wood-lined steel box cars, 25 caboose cars, six 100-ton flat cars, of which four will have depressed floors and two will have depressed floors and wells, and 20 passenger cars.

In addition to the $7,306,290 program, the Milwaukee is also contemplating the purchase of at least one Diesel-electric main-line freight locomotive for use in Idaho and Washington, and the expenditure of $2,500,000 for the modernization of locomotives and locomotive servicing facilities.

Detroit, Toledo & Ironton.—The D. T. & I. has asked the Interstate Commerce Commission for authority to assume liability for $1,150,000 of equipment trust certificates, maturing in equal annual installments of $115,000 on March 1, in each of the years from 1942 to 1951, inclusive. The proceeds will be used as part payment for new equipment costing a total of $1,474,000 and consisting of 300 gondola cars, four steam locomotives, and two Diesel-electric locomotives.

Illinois Central—The Illinois Central is reported to be in the market for one two-car passenger train.

Kansas City Southern.—The Kansas City Southern is reported to be in the market for one or two rail motor cars.

Lehigh Valley.—The Lehigh Valley is reported to be contemplating the acquisition of some small Diesel-electric switching locomotives.

New York, Ontario & Western.—The N. Y. O. & W. is reported to be contemplating the acquisition of four small Diesel-electric switching locomotives.

Norfolk & Western.—The N. & W. is reported to be contemplating building five or six mallet type locomotives in the company's own shops.

Supply Trade Notes

THE ARDCO MANUFACTURING COMPANY has moved from its plant in Jersey City, N. J., into larger quarters at 1116 Paterson Plank Road, North Bergen, N. J.

◆

ROBERT WATSON, formerly western sales manager, locomotive equipment division, of Manning, Maxwell & Moore, has been appointed western sales manager of the Waugh Equipment Company with offices in Chicago. Mr. Watson was associated with the American Locomotive Company from 1923 to 1926, at which time he joined the mechanical department of the Erie. In 1929 he was appointed mechanical engineer of the Firebar Corporation and continued in that capacity for six years after the merger of the Firebar Corporation with the Waugh Equipment Company in 1932.

◆

F. H. LINDUS, branch manager in charge of the service-sales division of the Timken Roller Bearing Company, with headquarters at Los Angeles, Calif., has been transferred to Canton, Ohio, where he is engaged in general sales promotional work.

(Turn to next left-hand page)

◆

NEWTON P. SELOVER has been appointed western sales manager of the locomotive equipment division of Manning, Maxwell & Moore, Inc., with headquarters at Chicago. For the past seven years Mr. Selover has represented the locomotive equipment division on the Pacific coast, with headquarters in San Francisco, Calif.

Mean Effective Pressure *determines* Locomotive Performance

In a paper issued by the Office of Mechanical Engineer of the A. A. R. in February, 1939, covering A. A. R. Passenger Locomotive Tests in October, 1938, the following statement appears:

> ". . . Nothing developed in the tests to indicate that any of the locomotives had reached the limit of boiler capacity. Therefore, the question of sustained power at high speeds becomes a question of mean effective pressure in the cylinders . . ."

THE FRANKLIN SYSTEM OF STEAM DISTRIBUTION

Exhaustive tests have demonstrated that the Franklin System of Steam Distribution makes it possible for a locomotive to develop the maximum mean effective pressure. It provides:

1. Separation of valve events, so that admission, cut-off, release and compression are independently controlled.
2. Larger inlet and exhaust passages and improved steam flow.
3. Reduced cylinder clearance volume.
4. Increased mechanical efficiency, obtained by reduced weight of moving masses, reduced friction and elimination of carbonization.

The Franklin System of Steam Distribution is offered to the railroads of the United States to meet the objective outlined in the A. A. R. report.

FRANKLIN RAILWAY SUPPLY COMPANY, INC. NEW YORK CHICAGO MONTREAL

MARION LAW, JR. has been appointed public relations director for the Edward G. Budd Manufacturing Company, succeeding W. Howe Sadler who has resigned. Mr. Law has been with the Budd Company for two years as a publicity representative. Prior thereto he was in charge of the New York office of the T. W. A. News Bureau.

Marion Law, Jr.

◆

CLARENCE C. RAUSCH, who has been affiliated with the Dearborn Chemical Company, Chicago, for 20 years, has been appointed assistant vice-president in charge of NO-OX-ID sales to railways, with headquarters at Chicago. During the last 10 years, Mr. Rausch has devoted his time to the promotion of NO-OX-ID rust preventive in the railway industry. Prior to his service with the Dearborn Chemical Company, he spent four years in the operating department of the Pennsylvania.

Clarence C. Rausch

◆

GRIP NUT COMPANY.—*E. H. Weigman,* who was appointed sales manager for the Grip Nut Company on January 1, 1941, has now been elected vice-president in charge of sales with headquarters in Chicago. *John D. Ristine* has been appointed assistant to the president, with headquarters at Chicago, and *Erastus Emery,* eastern district sales manager, with headquarters at Pittsburgh, Pa. A sketch and photograph of Mr. Weigman appeared in the February issue, page 86.

AMERICAN LOCOMOTIVE COMPANY.—*J. G. Blunt,* formerly chief mechanical engineer, has been appointed assistant to the vice-president in charge of engineering of the American Locomotive Company. Sherman Miller, superintendent of the general drawing room at Schenectady, succeeds Mr. Blunt as mechanical engineer.

J. G. Blunt was graduated with a degree in mechanical engineering from the University of Michigan in 1894. During his early business career he was employed as a machinist at the Buda Company, Harvey, Ill.; draftsman at the Welland Iron Works, Welland, Ont., and draftsman at the Bucyrus Company and the Industrial Works, Bay City, Mich. In 1897 he took a position as draftsman with the Brooks Locomotive Works at Dunkirk, N. Y., becoming chief draftsman in 1899. In 1906, following the formation of the American Locomotive Company, of which the Brooks Locomotive Works became a part, he was transferred to Schenectady, N. Y., and appointed engineer of the drafting department. In 1916 Mr. Blunt became mechanical engineer and in 1936 chief mechanical engineer. In 1923 he was vice-chairman of the A. S. M. E., Schenectady division.

James G. Blunt

Sherman Miller after leaving high school became employed in the erecting shop of the Brooks Locomotive Works and four years later was transferred to the drawing room. After attending Purdue University (class of 1905, mechanical engineering) Mr. Miller returned to the Brooks Locomotive Works and in 1907 was appointed assistant chief draftsman. In July of that year he was transferred to Schenectady, N. Y., where the general drawing room of the American Locomotive Company was being organized, and in 1916 became superintendent of the general drawing room.

Sherman Miller

◆

AMERICAN BRAKE SHOE & FOUNDRY CO.—*A. H. Elliot,* vice president of the Southern Wheel Division of the American Brake Shoe & Foundry Company, has been placed in charge of development, engineering and service. Mr. Elliot graduated from the Sheffield Scientific School in 1904 and was with the Pennsylvania until 1909, at which time he joined the American Brake Shoe & Foundry Co. He was elected vice-president of the Southern Wheel division in 1927. *J. T. Talbot* has been elected vice-president in charge of sales. He has been associated with the company since 1920 and is also vice-president of the Brake Shoe & Castings division. *W. C. Appleby* has been appointed operating manager. Mr. Appleby started with the Decatur Car Wheel Company in 1906, shortly after graduating from Georgia Tech and became a member of the Southern wheel organization when the Decatur Company was taken over. *J. B. Spencer* has resigned as vice-president of the Southern Wheel division to devote all his time to the Ramapo Ajax division, of which he is president.

Obituary

WILLIAM T. BENNISON, a railroad contact officer of the Edward G. Budd Manufacturing Company, died March 16 after a protracted illness. He was 50 years of age. Mr. Bennison graduated from Syracuse University in 1913 and entered the employ of the Chicago, Milwaukee, St. Paul & Pacific, where he later became engineer of tests. During his subsequent business career he was assistant mechanical engineer; development and service engineer of the Locomotive Feedwater Heater Company (now the Superheater Company); equipment engineer with the Westinghouse Electric and Manufacturing Company, and assistant chief engineer of the Corning Glass Company. He joined the Budd

William T. Bennison

(*Continued on next left-hand page*)

"Tailor Made"

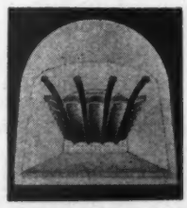
YET STANDARDIZED!

Each Security Arch is "tailor made" to suit the individual class of power in which it must function. But so effectively is Security Arch Brick standardized that only six different Security Brick patterns are needed for more than 50% of the Security Arch Brick used.

This high standardization reflects the engineering and experience of the American Arch Company.

It simplifies the application of the brick arch and saves the stores department a vast amount of trouble.

This foresight of the American Arch Company in adhering to standards is but one of the many ways in which the American Arch Company is serving the railroads.



There's More to
SECURITY ARCHES
Than Just Brick

HARBISON-WALKER REFRACTORIES CO.

Refractory Specialists

AMERICAN ARCH CO.
INCORPORATED
60 EAST 42nd STREET, NEW YORK, N. Y.
Locomotive Combustion Specialists

Company in 1933 to help produce the first Diesel-electric stainless steel Zephyr. He was a member of the New York Railroad Club and the Western Railway Club.

◆

HENRY S. MANN, who retired as district sales manager of the Standard Stoker Company, Inc., Chicago, on March 1, 1939, died in that city on March 16 of a heart ailment. Mr. Mann was born in New Hampshire on September 23, 1865, and entered railway service on the Old Colony. Later he was employed on the Wabash, the Illinois Central, and the Northern Pacific, following which he served as service engineer of the Westinghouse Air Brake Company and western manager of the Metal & Thermit Corporation. He resigned from the latter position in 1924 to become district sales manager of the Standard Stoker Company, Inc.

Personal Mention

General

C. O. YOUNG, assistant chief clerk in the car department of the Illinois Central at Chicago, has been promoted to the newly created position of assistant to the superintendent of equipment at Chicago.

L. L. HOEFFEL, master mechanic of the Union Pacific at Los Angeles, Cal., has been appointed superintendent of motive power and machinery of the South-Central and Northwestern districts, with headquarters at Pocatello, Idaho.

P. O. CHRISTY, master mechanic of the Illinois Central at Paducah, Ky., has been promoted to superintendent of equipment, a newly created position with headquarters at Chicago. Mr. Christy was born at

Paul O. Christy

Water Valley, Miss., on August 1, 1898, and entered railway service on May 1, 1912, as a call boy in the mechanical department at Water Valley, later serving as a clerk and a machinist apprentice at Water Valley, a timekeeper at Memphis, Tenn., and a machinist apprentice at McComb, Miss. During the first World War he was a machinist mate in the U. S. Navy. He returned to McComb on August 16, 1919, and was promoted to machinist on March 1, 1920, serving successively at Baton Rouge, La., Memphis, and Asylum, Miss. On October 17, 1925, he became enginehouse foreman at Gwin, Miss., being later transferred to Asylum. On October 1, 1930, he was appointed to general foreman and on January 1, 1935, was transferred to Centralia, Ill. Mr. Christy became assistant master mechanic at the Markham yards, Chicago, on May 1, 1937, and master mechanic at Paducah, Ky., on January 16, 1938.

A. F. COULTER, superintendent of rolling stock of the Union Railroad, with headquarters at East Pittsburgh, Pa., retired from active service on February 12, after 45 years of continuous railway service. Mr. Coulter began his career in 1896 as a car repairman at the Glenwood shops of the Baltimore & Ohio and became car inspector in 1898. In 1900 he was appointed chief car inspector and was sent to McKees Rocks, Pa., to supervise the construction of 9,500 all-steel hopper and gondola cars at the plant of the Pressed Steel Car Company. At the completion of this work in 1901, he returned to the Glenwood shops as car foreman. He was appointed general car foreman in 1903, and in 1907, resigned to accept a similar position with the Union Railroad. Mr. Coulter became master car builder of the Union Railroad in 1926 and superintendent of rolling stock in 1936.

STANLEY C. SMITH, superintendent of motive power and machinery of the South-Central and Northwestern districts of the Union Pacific, with headquarters at Pocatello, Idaho, has been appointed acting general superintendent of motive power and machinery, at Omaha, Neb. Mr. Smith was born at New Albany, Ind., on October 1, 1895, and entered railway service in 1911 as a machinist apprentice on the Southern. In 1915, he became a machinist on the Chicago, Rock Island & Pacific, later serving in that capacity on the Evansville & Indianapolis (now part of the Big Four) and the Chicago, Terre Haute & Southeastern (now part of the Chicago, Milwaukee, St. Paul & Pacific). In February, 1920, Mr. Smith went with the Union Pacific as assistant enginehouse foreman at Green River, Wyo. He was transferred to Pocatello as district foreman in 1933, and in 1936 was promoted to master mechanic. In 1939 he became assistant general superintendent of motive power and machinery for the South-Central and the Northwestern districts, with the same headquarters, and later his title was changed to superintendent of motive power and machinery.

JOHN FRANCIS BURNS, works manager of the Angus shops of the Canadian Pacific at Montreal, Que., who has retired because of ill health, as noted in the March issue of the *Railway Mechanical Engineer*, was born on October 14, 1877, at Montreal. He attended the Sansfield School from 1883-1892 and on October 14, 1892, entered the employ of the Grand Trunk, serving five years as an apprentice and one as a fitter. He entered the service of the Canadian Pacific in 1898, as a fitter in the mechanical department, Windsor Station, Montreal. Later, he was leading hand fitter and locomotive foreman at North Bay, Ont., White River, and Chapleau. Mr. Burns became district master mechanic

J. F. Burns

at North Bay, in 1908; and, successively, district master mechanic at London, Ont., and master mechanic, eastern division, with headquarters at Montreal in 1911. In 1918, he was promoted to the position of assistant works manager at the Angus shops and the following year became works manager. The special royal train for the visit of King George VI and Queen Elizabeth in 1939 was fitted under the supervision of Mr. Burns.

G. W. BIRK has been appointed assistant to general superintendent of motive power of the New York Central at New York.

JOHN GOGERTY, superintendent of motive power and machinery for the Eastern district of the Union Pacific, has had his headquarters transferred from Omaha, Neb., to Cheyenne, Wyo.

Master Mechanics
Road Foremen

J. A. WELSCH, general foreman of the Illinois Central at New Orleans, La., has become master mechanic at Paducah, Ky.

W. F. KASCAL, general foreman on the Chicago, Burlington & Quincy at Lincoln, Neb., has been appointed acting master mechanic of the Lincoln and Wymore divisions, with the same headquarters, succeeding T. E. Paradise, who has been ill for some time.

PAUL THOMAS, assistant master mechanic of the Philadelphia division of the Pennsylvania, who has been promoted to master mechanic of the Chicago Terminal and Logansport divisions at Chicago, as announced in the February issue, was born on September 30, 1898, at Elkhart, Ind.

Paul Thomas

He was graduated from Elkhart high school in 1918 and from Purdue University in 1923. He entered railway service on June 29, 1923, as a special apprentice on the Pennsylvania at Altoona, Pa., and on June 4, 1926, became motive-power inspector. On February 1, 1929, he was transferred, as motive-power inspector, to Wilmington, Del., and on December 15, 1929, became gang foreman at York, Pa. Mr. Thomas was appointed enginehouse foreman at Wilkes-Barre, Pa., on March 1, 1932; assistant master mechanic, New York division, on April 16, 1937; enginehouse foreman, Williamsport, Pa., on June 15, 1938; assistant master mechanic, Mingo Junction, Ohio, on October 26, 1939; and assistant master mechanic, Enola, Pa., on August 1, 1940. From June to December, 1918, Mr. Thomas was in U. S. N. R. F. service.

WILL ANDERSON TRAYLER, JR., acting master mechanic of the Columbus & Greenville, has been appointed master mechanic

W. A. Trayler, Jr.

with headquarters as before at Columbus, Miss. Mr. Trayler was born on September 22, 1910, at El Paso, Tex. He received the degree of B.S. in mechanical engineering (with railway mechanical engineering option) at Purdue University in January, 1936. During the second semester, 1935-36, he was an instructor in machine design and mechanical laboratory at Purdue University. He was mechanical engineer on production at the Barberton works of the Babcock & Wilcox Co., from 1936 to 1938. He entered the service of the Columbus & Greenville on August 1, 1938, and on January 16, 1940, became acting master mechanic of the Columbus & Greenville at Columbus.

J. F. HUNT, foreman, Philadelphia division of the Pennsylvania, has been appointed assistant master mechanic of the Philadelphia division.

A. R. SNYDER, acting master mechanic for the Union Pacific at Council Bluffs, Iowa, has been promoted to master mechanic at that point.

EDWARD JOSEPH BURCK, superintendent of shops of the Michigan Central at Jackson, Mich., has been appointed division master mechanic of the New York Central System with headquarters at St. Thomas, Ont. Mr. Burck was born on January 29, 1883, at Monroe, Mich. He entered rail-

E. J. Burck

way service on August 14, 1901, as a machinist apprentice on the Michigan Central at Jackson. He became a machinist in 1904, and enginehouse foreman in 1909. He was transferred as enginehouse foreman to Kalamazoo, Mich., in 1913, and to Jackson in 1918. In 1926, he was appointed superintendent of shops at Jackson.

WILLIAM HENRY GIMSON, general foreman on the St. Louis-San Francisco at Springfield, Mo., who has been promoted to master mechanic of the Southwestern and Western divisions, with headquarters at West Tulsa, Okla., as announced in the February issue, was born on September 13, 1887, at Memphis, Tenn. He entered railway service on September 1, 1904, as toolroom attendant for the St. Louis-San Francisco at Memphis and later became a machinist apprentice. Upon the completion of his apprenticeship, he became a machinist and subsequently was appointed assistant enginehouse foreman. On June 10, 1917, he was promoted to general foreman, at Monett, Mo.; on May 1, 1924, was transferred as general foreman to Memphis, and on August 16, 1929, was appointed superintendent, North shops, Springfield, Mo., and on September 5, 1931, was appointed general foreman of the North shops and enginehouse at Springfield, Mo.

Car Department

JOHN I. OKERBERG has been promoted to car foreman of the Atchison, Topeka & Santa Fe at Ottawa, Kan.

C. R. KERR has been appointed general car foreman of the Union railroad, with headquarters at East Pittsburgh, Pa.

W. B. WEIGHTMAN, assistant road foreman of engines of the Philadelphia division of the Pennsylvania, has been promoted to general air brake inspector, Central region.

L. R. (RAY) CHRISTY, master car builder of the Gulf Coast Lines and of the International-Great Northern, with headquarters at Houston, Tex., has been

L. R. Christy

appointed superintendent of the car department of the Missouri Pacific Lines, with headquarters at St. Louis, Mo., and the positions of master car builder on the Missouri Pacific, the Gulf Coast Lines, and the International-Great Northern have been abolished. Mr. Christy was born at Water Valley, Miss., on December 19, 1894, and entered railway service on the Illinois Central as a car repairer apprentice at Water Valley. In April, 1912, he was promoted to car repairer, and was later air brake repairer, car inspector, chief clerk and traveling master car builder inspector. On June 9, 1916, he went to Tuscon, Ariz., as M. C. B. clerk on the Southern Pacific and until January 31, 1922, he alternately worked in various capacities in the mechanical department at Tuscon and attended the University of Arizona. Mr. Christy returned to the Illinois Central on February 3, 1922, as an air-brake foreman at Memphis, Tenn., later being appointed rebuilding car foreman. On March 1, 1924, he went with the Missouri Pacific as assistant general car inspector, and a short time later became general car inspector. On February 16, 1926, he was appointed master car builder of the Gulf Coast Lines and the International-Great Northern, with headquarters at Houston.

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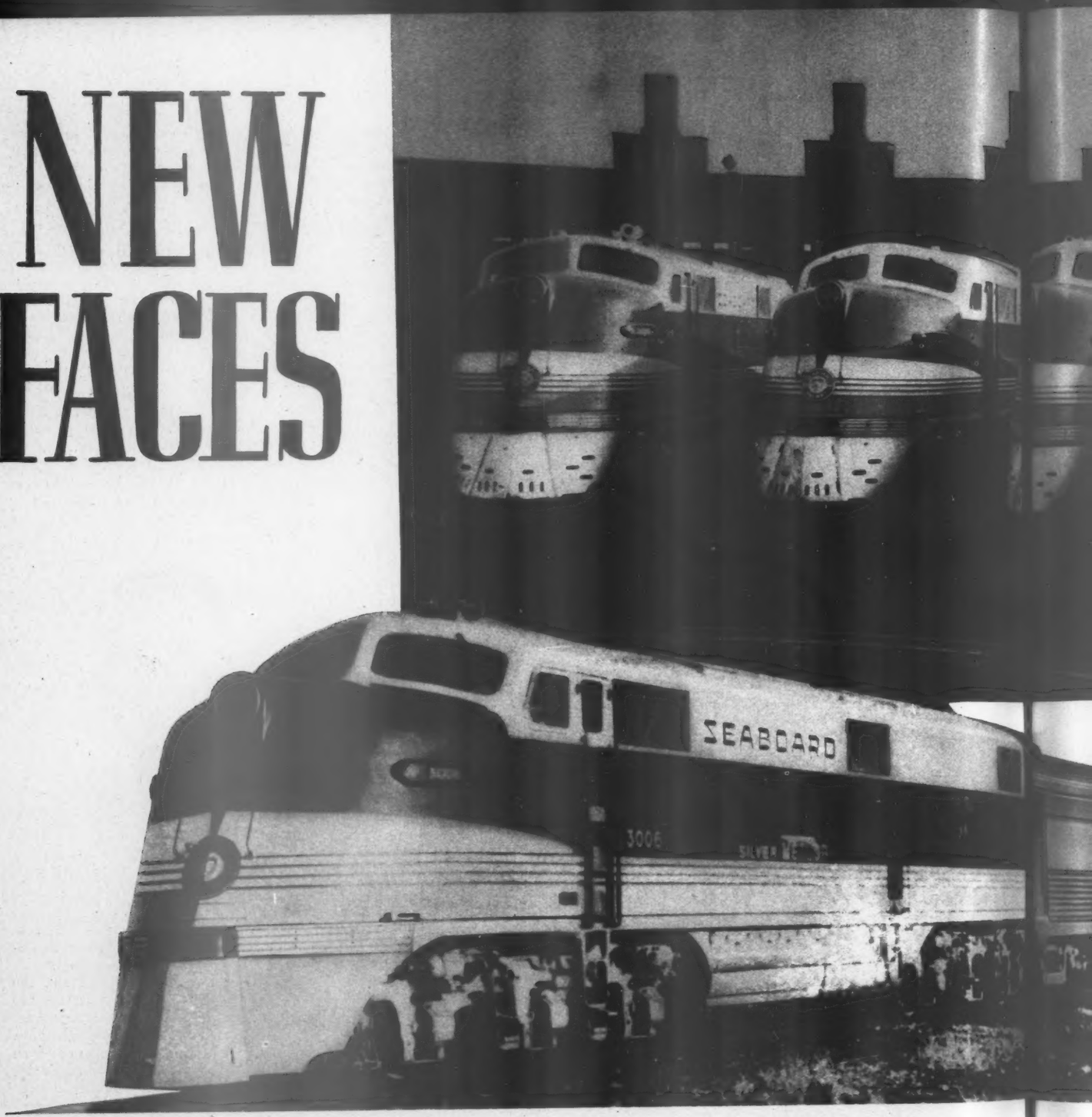
NEW FACES



SEABOARD RAILWAY
THROUGH THE HEART OF THE SOUTH

GM
GENERAL MOTORS
DIESEL POWER

NEW RECORDS

ON DECEMBER 15th, 1938, the Seaboard inaugurated its famous "ORANGE BLOSSOM SPECIAL" luxury all-Pullman EMC 6000 hp. Diesel-powered trains to Miami, and followed immediately on February 2nd, 1939, with its also famous "SILVER METEOR" deluxe all-coach streamlined train. Success was immediate. Passenger revenues jumped month after month as a result of these new high standards of travel comfort, "on-time" arrivals, and faster schedules with maximum safety.

The record increase in passenger travel and passenger revenues has required continual expansion of this service so that today a fleet of 20 EMC 2000 hp. Diesel units is handling these modern trains between Washington, Miami, Tampa and St. Petersburg . . . further proof that

"PASSENGER SERVICE CAN BE PROFITABLE!"

ELECTRO-MOTIVE CORPORATION

SUBSIDIARY OF GENERAL MOTORS LA GRANGE, ILLINOIS, U. S. A.

ROBERT N. HOLLAND, foreman of the freight car department of the Lehigh Valley at Sayre, Pa., has been promoted to general foreman of the passenger and freight car departments at Sayre.

ROLAND H. MARQUART, superintendent of the freight-car department of the Illinois Terminal Railroad, who has been transferred from Decatur, Ill., to St. Louis, Mo., as noted on page 44 of the January issue, was born on May 3, 1888, at Sandusky, Ohio. He attended public school in San-

R. H. Marquart

dusky and on April 19, 1905, entered the service of the Baltimore & Ohio at Sandusky. He was consecutively a laborer, car repairman, car inspector and piecework inspector, until May 31, 1911, when he became car foreman at Washington, Ind. On February 20, 1912, he was transferred as car foreman to East St. Louis, Ill. He was appointed general car foreman at Chillicothe, Ohio, on September 1, 1914; general car foreman at Willard, Ohio, on October 1, 1917, and car foreman at Collinsville, Ill., on June 8, 1918. From the latter date until May 1, 1919, Mr. Marquart was in the employ of the Pennsylvania Railroad. He then became assistant chief interchange inspector at St. Louis and East St. Louis Terminals. On October 1, 1930, he returned to the Illinois Terminal as general car foreman at Decatur and on June 1, 1936, was appointed superintendent of the freight-car department.

CHARLES H. LUNDBERG, general car foreman of the Ottawa car works of the Atchison, Topeka & Santa Fe at Ottawa, Kan., has retired.

E. H. WATERMAN, general car foreman of the Union Railroad at East Pittsburgh, Pa., has been promoted to master car builder.

E. O. ROLLINGS at the South Louisville shops (Louisville, Ky.) of the Louisville & Nashville, now functions under the title of superintendent of the South Louisville shops, instead of under the title of master mechanic.

L. E. HILSABECK, general car inspector of the Chicago Great Western, has been appointed to fill the newly created position of assistant superintendent of the car department, with headquarters as before at Oelwein, Iowa.

F. E. CHESHIRE, general car inspector, Missouri Pacific, has been promoted to the newly created position of assistant superintendent car department of the same road, effective March 1. Mr. Cheshire is a vice-president of the Car Department Officers' Association.

Shop and Enginehouse

CHARLES S. WILLIAMS, general foreman on the Delaware & Hudson at Colonie, N. Y., has been appointed shop superintendent at Colonie. Mr. Williams was born on March 8, 1881, at Syracuse, N. Y. He received his education through the International Correspondence School and entered railway service as a machinist apprentice on the New York Central on April 1, 1895. He became a machinist on June 1, 1899, and shop piecework inspector, on June 25, 1909, and general piecework inspector motive power department, Lines East, on May 3, 1911. On March 1, 1913, he went to Grand Rapids, Mich., as shop superintendent of the Pere Marquette. On April 1, 1916, he went to Dunkirk, N. Y.,

Charles S. Williams

as foreman inspector for the New York Central at the plant of the American Locomotive Company. He was assistant master mechanic in the employ of the American Car and Foundry Company at Depew, N. Y., from January, 1918, until May, 1920, and night superintendent of the Buffalo Steel Car Co. at Buffalo, N. Y., from May, 1920, to November, 1922. In November, 1922, he became general piecework supervisor on the Delaware & Hudson at Colonie, and in June, 1923, general foreman at Colonie. He was appointed shop superintendent on October 16, 1940.

T. J. LYON has been appointed superintendent of shops of the Boston & Albany, at West Springfield, Mass.

WILLIAM E. BUCK, machine foreman on the Michigan Central at Jackson, Mich., has become superintendent of shops at that point.

R. W. BARRETT, general boiler foreman of the Canadian National at Stratford, Ont., has been appointed chief boiler inspector, with headquarters at Toronto, Ont.

Purchasing and Stores

F. C. HOLTON, assistant superintendent motive power of the Virginian, has been appointed purchasing agent, with headquarters as before at Norfolk, Va., to succeed D. C. King, who has been appointed acting general manager. The position of assistant superintendent motive power has been abolished.

Obituary

M. V. MILTON, chief boiler inspector of the Canadian National at Toronto, Ont., died on February 19. Mr. Milton was a past president and life member of the Master Boiler Makers' Association.

JOHN J. MANSFIELD, who retired about five years ago as chief boiler inspector of the Central of New Jersey, died on January 30.

JAMES J. O'NEAL, superintendent of the car department of the Gulf, Mobile & Ohio, at Mobile, Ala., died on February 26, after a short illness. Mr. O'Neal was born at Arcadia, Mo., on March 3, 1869, and entered railway service on March 1, 1890, with the St. Louis, Iron Mountain & Southern (now part of the Missouri Pacific). In 1900 he entered the employ of the St. Louis, Memphis & South Eastern (now the St. Louis-San Francisco) and on January 1, 1905, went with the Mobile, Jackson & Kansas City (now part of the Gulf, Mobile & Ohio) as a general car foreman, later becoming superintendent of the car department.

W. F. BUSCHER, general master mechanic of the Minneapolis, St. Paul & Sault Ste. Marie, with headquarters at Minneapolis, Minn., died suddenly of a heart attack on February 6, at Minneapolis. Mr. Buscher was born at Green Bay, Wis., on June 15, 1880, and entered railway service on the Chicago, Milwaukee, St. Paul & Pacific as a machinist apprentice at Green Bay, later becoming a machinist. On December 26, 1906, he went with the Soo Line as an enginehouse foreman at Enderlin, N. D., and later served in that capacity at Harvey, N. D., Glenwood, Minn., and Superior, Wis. Mr. Buscher was promoted to assistant master mechanic at Wishek, N. D., on December 1, 1915; to master mechanic at Superior on May 1, 1918, and to general master mechanic at Minneapolis, Minn., on June 1, 1926.

J. H. GIMPEL, assistant superintendent, car department, of the Wabash, with headquarters at Decatur, Ill., died on February 13. Mr. Gimpel was born on August 12, 1875, and entered railway service in 1891 as an apprentice on the Missouri Pacific. From 1899 to 1918 he was employed by the Mexican Central as general car foreman, and by the National Railways of Mexico, the Missouri Pacific, the Vera Cruz & Pacific, the St. Louis San Francisco and the Denver & Rio Grande Western as master car builder. During the World War he served the United States Railroad Administration as supervisor of car repairs for the Western region of the United States. In 1920 Mr. Gimpel became superintendent of shops of the Grand Trunk at Port Huron, Mich., and in 1922 entered the employ of the Wabash as assistant superintendent, car department, at Decatur.